SCIENTIFIC AMERICAN

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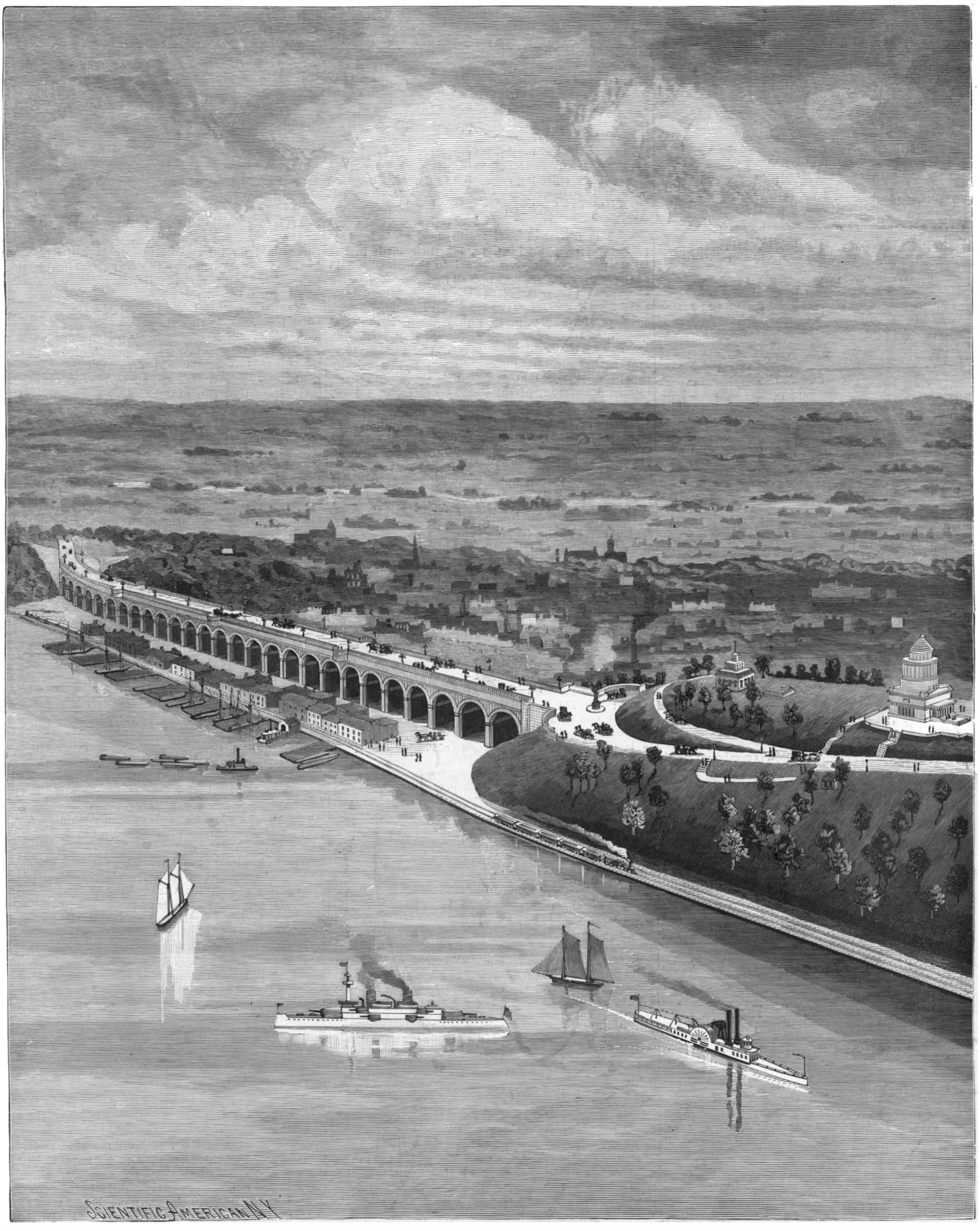

EXTENSION OF THE RIVERSIDE DRIVE, NEW YORK—THE PROPOSED NEW STEEL VIADUCT.—[See page 102.]

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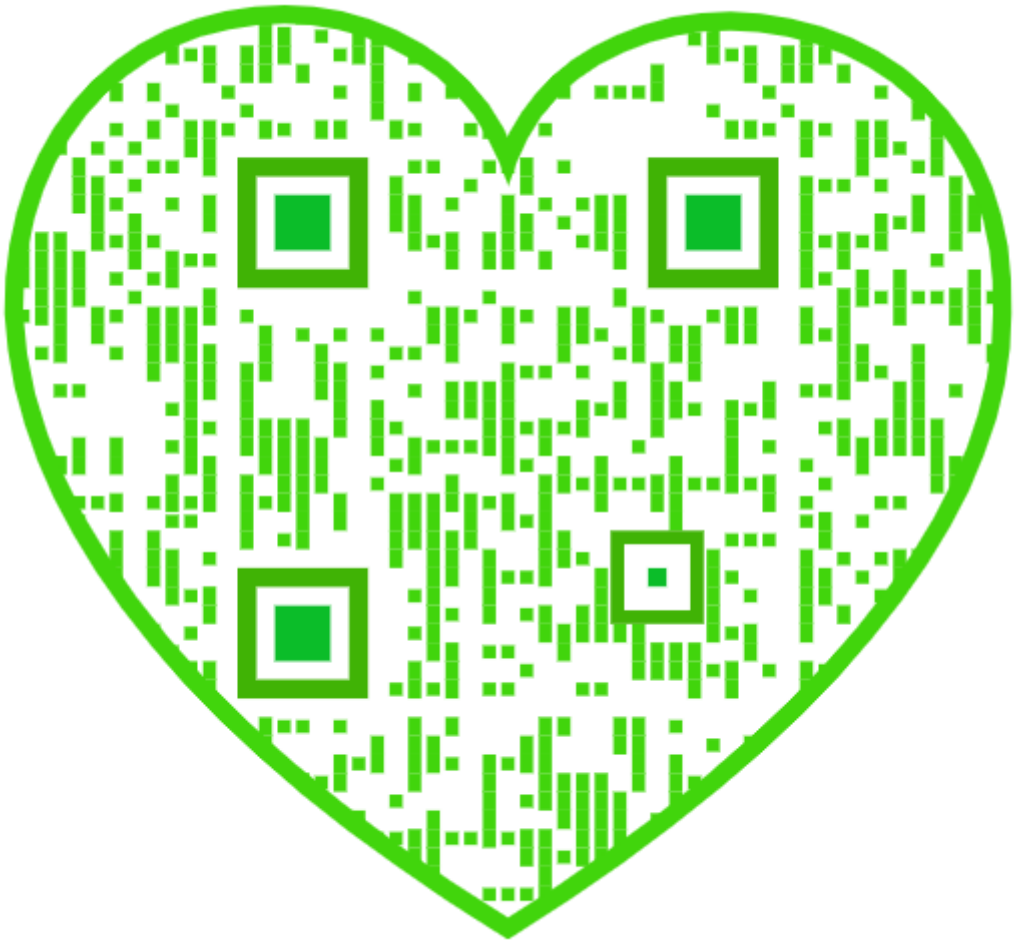

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THE LIQUEFACTION OF AIR.*

If Baron Munchausen had recorded that he once came upon a people who were in the habit of changing air into the liquid state and carrying it around in vessels, the statement would have been regarded as a particularly happy effort of that accomplished artist. An assertion so at variance with all human experience would have failed to command belief, even if indorsed by the testimony of less impeachable witnesses than the observant baron.

We are speaking of a bygone age. To-day the public knows better than to deny a statement offhand merely because it contradicts or does not agree with its common experience. The loophole of escape from unexplained phenomena in the days of our forefathers was by assertion of flat disbelief or ascription to witchcraft or the devil. To day, at the first announcement of the wonderful, the public neither believes nor disbelieves; for the incredibly rapid march of science and discovery has taught the world that the marvels and impossibilities of yesterday may easily become the commonplace facts of to-day. But two brief years ago it was whispered from across the ocean that a certain German professor had succeeded in passing light through so-called opaque bodies—wood, leather, the flesh—and the technical press announced the fact with a prefatory "it is said," "a contemporary reports," etc., neither affirming nor caring to deny a statement apparently so preposterous. To-day the fluoroscope is a toy that has lost its charm, and an X-ray equipment is a necessary part of the surgeon's outfit.

The liquefaction of air is another of those feats of experimental science which, having their birth in the laboratory, ultimately graduate into the broader field of the industrial arts, and lose all their wonder as they become useful and familiar to the public. It must not be supposed, however, that because it has only now become possible to produce liquid air in commercial quantities, therefore the principles of its liquefaction are new or only of late discovery. It has long been known that air, like any other gas, was theoretically capable of liquefaction, and that its condensation was merely a question of suitable apparatus. To Prof. Dewar, of Glasgow, belongs the credit of first liquefying air in limited quantities, the necessary reduction of temperature being achieved by a successive series of evaporations. The process, however, was too costly to have any commercial value.

The economical liquefaction of air in large quantities has been recently accomplished by Mr. Charles E. Tripler, of New York, after several years of experimental work. Two and a half gallons of the liquid were recently sent from his laboratory to Prof. Barker, of the University of Pennsylvania, and its properties were exhibited in an extremely interesting series of experiments during a lecture delivered by Prof. Barker to his class and a company of invited guests. This was the first public exhibition of the kind of this article in the United States.

The laws governing the existence of air in the liquid or gaseous state are the same as those for water—to take a substance with which we are most familiar. Above a certain temperature and pressure (212° F. and atmospheric pressure at the sea level) water exists as a vapor; from 212° F. to 32° F. at the same pressure it is a liquid, and below that temperature it is a solid. In its normal condition air, as we know it, is a gas, just as in its normal condition water is a liquid; but if we lower the temperature or increase the pressure, or both, of air to a sufficient degree, we reach a point at which condensation takes place. The liquefaction point of air under normal atmospheric pressure is 311·8° below zero by the Fahrenheit scale.

Mr. Tripler's method of liquefaction is based upon the fact that, if a gas be compressed and allowed suddenly to expand, it absorbs the heat of the surrounding medium, thereby producing intense cold. He compresses air to 2,000 pounds to the square inch, passes it through a coil and permits it to issue from a needle point orifice. There it expands and cools. This cold stream of air circulates around a second coil through which compressed air is flowing, reducing the temperature of the latter. The air issuing from this second coil has its temperature lowered to a point due to its own expansion, plus the cold imparted from the first expansion. The expanded and extremely cold air from the second coil is used similarly to cool a third coil, the air in which is brought down to a temperature of 311·8° F. and below, at which it condenses and flows from the end of the coil in a liquid stream.

In the course of his lecture Prof. Barker made a number of curious experiments with the liquid, illustrating the operation of the laws governing the formation of solids, liquids and gases. When it was poured into a tumbler it boiled until it had absorbed the heat of the glass. The cold gas given off condensed the moisture in the air above the glass, which fell in the form of hoar frost. A piece of tin thrust into the liquid made it boil and the tin was rendered as brittle as glass. Copper and platinum were not so affected, and it is evident that these metals will make suitable receptacles for this new liquid. When it was boiled over a furnace the ebullition was, of course, excessive; but the moment water was poured into the boiling liquid, the former was instantly frozen. Alcohol and mercury were frozen when brought in contact with the new product. The liquefaction point of the two constituents of air is different, that of oxygen for given pressures being several degrees higher than that of nitrogen. Hence, as the temperature of the liquid rises, the nitrogen is the first to escape as a gas. The remaining liquid is proportionately rich in oxygen—a fact which is proved by the bluish tint which a standing vessel of the liquid assumes if exposed to the air. Just what the economic value of this new and extremely interesting product is, time will show; but in experimental work in the laboratory it will be certain to find a ready field of usefulness.

* A series of valuable papers on this subject, by various authors, including Prof. Dewar, has been published in the following numbers of the SCIENTIFIC AMERICAN SUPPLEMENT: 846, 932, 948, 967, 970, 972, 1042.

FALSE ECONOMY.

The reluctance of Congress to push forward the coast fortifications proves that the sound business principles which govern men in the conduct of their private business are too often forgotten or violated in the administration of public affairs.

No one who is entitled to speak intelligently on the subject denies that the wealthy cities on the United States seaboard are at the mercy of an attacking fleet. Our coastline is so extensive and the number of ships in our navy is relatively so limited that every one of our seaports should be in a position to repel, unaided by the fleet, a hostile attack. At present not one of them could do this. Admirable as are the plans of fortification drawn up by the War Department, they still exist, thanks to the indifference of Congress, largely upon paper.

Adequate fortifications are to the protected city what insurance is to a building. No good business man would think of putting up a factory without placing an adequate insurance upon it. No nation in the world but one would dream of allowing its wealthiest cities to lie exposed to the attack of any petty state that can afford to buy a cruiser or two from foreign and competitive nations that are only too ready to furnish them. Looked at from a purely business standpoint, the few million dollars asked for fortifications are to be spent in taking out an insurance upon the thousands of millions of property which are now exposed to possible destruction.

This year's fortifications bill has suffered, as usual, a reduction at the hands of the House Committee, and the knife has been applied so effectively that less is to be conceded than for the two years previous, and the War Department's estimate is cut down two-thirds. Two years ago the appropriation was $7,377,888, and last year $9,517,141. This year a request was made for $13,378,571, whereas the bill as reported provides for only $4,144,912.

The policy of the present Congress may, perhaps, have been influenced by the fact that our foreign relations are less strained than they were when the liberal appropriations of two years ago were made. But it should be remembered that the building of fortifications and guns of the modern costly type is not or should not be emergency work. Activity in this line should never be determined by the aspect of political affairs. To return to our comparison, no one thinks of waiting until his neighbor's house is on fire before taking out an insurance upon his own.

GROWTH IN OUR EXPORTS OF AMERICAN LOCOMOTIVES.

The American locomotive is evidently winning favor in the foreign countries into which it has been introduced. Whether the disastrous strike of the engineers in Great Britain has had anything to do with the large number of orders which have recently been placed in this country or not, it is a fact that the foreign trade has been growing at a steady pace and helped materially to keep our builders busy during the past few months. Japan in particular has shown her satisfaction with the American locomotives which she has already purchased by sending in large orders for more. Her first purchases were made in 1894, when fifteen locomotives were ordered. This was followed by twenty-three in 1895 and another twenty-three in 1896. The figures for the current year will undoubtedly show a considerable increase over its predecessor. Our best customer is Brazil, to which country eighty-four locomotives were shipped in the year ending in June, 1897. Russia comes next with a total of seventy-four, while Mexico purchased twenty-three and Chile twenty-two.

There are many reasons why the American machine should give good satisfaction to these foreign countries. In the first place, it is considerably cheaper (35 to 40 per cent) than the European machine, and the lessened cost is obtained, thanks to our improved machinery and economical shop management, without any sacrifice of quality. It is possible that the American locomotive does not show so much bright work and costly painting as the European engine, but in all points that affect its efficiency it is fully up to the standard.

To this must be added the simplicity and accessibility

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of our machines—a feature of the greatest value in countries where skilled labor is comparatively scarce. The American locomotive bears the stamp of the practical men who have evolved it. It is essentially a "handy" machine. Moreover, the fact that its design has been modified by the requirements of the rough track and roadbed of our early railroads make it singularly well adapted to the new roads which are being built in such countries as Russia and Japan. The bar frame, the equalizing lever and the swinging truck combined give to the American locomotive a vertical and lateral flexibility which enables it to ride safely over track which would ditch a plate-frame engine before it had run a mile. It is also greatly in its favor that the generous proportions of its boiler give it a reserve capacity which must always render it popular with the superintendent and his staff of engineers.

In four years our exports of locomotives have risen from 195 to 338, and if the present rate of growth keeps up, we may hope before long to take a leading position in this important branch of the industry.

GUN OF NEW TYPE SUCCESSFULLY TESTED.

A very interesting and highly satisfactory preliminary test of a new type of steel gun was conducted during the latter part of January, at the Sandy Hook Proving Ground. The gun, which is of the 5-inch rapid-fire class, is so simple in construction that no drawings are needed to describe it to our readers. It is made of a single forging of steel, which, having followed the course of manufacture usual for large gun forgings, was, at a proper stage of manufacture, cooled from the interior from such temperature as to produce properly disposed initial strains of such intensity as would place the wall of the gun in the best condition to resist interior pressure.

The manufacture of the gun is due to the suggestions of Capt. F. E. Hobbs, Ordnance Department, United States army, who pointed out several years ago to the chief of ordnance the advantages that could be obtained in the manufacture of guns by applying to forgings a modification of the Rodman principle of casting guns; that the process as applied to forgings could be made to produce exactly the initial strains desired; that these strains could be easily increased or diminished at little cost and that guns so made, while quite as strong, would be much cheaper to make than those built up.

An experimental forging made under Capt. Hobbs' direction at the Bethlehem Iron Works showed such excellent results, on being cut up and carefully examined, that the chief of ordnance ordered this 5-inch gun to be manufactured.

The thickness of metal which the gun should have and the proper initial strains to be applied to give great strength were computed by Capt. R. Birnie, ordnance department, from his formulæ on the strength of guns. Capt. Birnie was an early convert to the methods of manufacture proposed, and has materially assisted Capt. Hobbs in perfecting the details of plans.

The gun is fitted with Gordon's breech mechanism, uses fixed ammunition, smokeless powder, a projectile weighing 55 pounds, can be fired from six to ten times per minute, depending upon the conditions of loading and aiming, and has a range of more than six miles. In the Sandy Hook tests a velocity of over 2,700 feet per second at the muzzle was shown, and in the special high pressure test to which the gun was subjected, pressures were registered of nearly 50,000 pounds per square inch.

The method of manufacture can be applied to forgings of any size that can be turned out by the steel-producing plants of the country; consequently, the caliber of gun which can be made of a single forging may be, to-day, set at 8-inch, but, by using this method, the number of parts in guns of larger caliber could be much reduced, while the guns themselves would be stronger.

It is probable, also, that the commercial engineering interests of the country will be found ere long following the lead of the ordnance department in this latest improvement in the treatment of steel forgings, as they did many years ago, in demanding for their structures oil-tempered and annealed steel forgings, after that department of the army had shown conclusively, by careful experimental investigation and by actual test, the safety and superiority of such metal.

A BRIEF REVIEW OF SOME BRANCHES OF THE WORK, SCIENTIFIC AND PRACTICAL, OF THE HEALTH DEPARTMENT OF THE CITY OF NEW YORK.

In view of the fact that the daily papers have called attention to a bill introduced in the legislature, by which it is proposed to curtail to a great extent the powers of the New York City Board of Health, it will be of interest to the readers of the SCIENTIFIC AMERICAN to know just what this board has accomplished in the last few years.

It is not the province of this article to go into an extended account of all the work of this department. Such an account can be found in the reports of the board to the Mayor. A summary statement of the most important work only can be given. The work of the department to which we shall refer might aptly be placed in two divisions—first, scientific research, and, second, the practical application of the same in the interests of public health. The whole of this work is in charge of the sanitary superintendent, who, with the co-operation of his divisional superintendents, has been enabled to make a truly marvelous showing in the sanitary condition of the city.

The research work, which is mainly carried on by the division of pathology and bacteriology, includes the study of the cause and effect of diseases, and their prevention and cure.

Every facility has been offered for this. Competent investigators with fully equipped laboratories are at their disposal.

Careful study has been made of the more important contagious diseases, so that the department is prepared to cope with any epidemic that might occur.

This division also makes and prepares for administration to the people the following antitoxic remedies: Diphtheria antitoxin for the prevention and cure of diphtheria; tetanus antitoxin, for the prevention and cure of lockjaw; vaccine virus, for the prevention of smallpox; tuberculin, for the diagnosis of tuberculosis (consumption); mallein, for the diagnosis of glanders in horses.

Other biological products of the laboratories that are being tested with a view of ascertaining their usefulness are: Typhoid antitoxin, for the cure of typhoid fever; streptococcus antitoxin, for streptococcic infection, such as occurs in erysipelas, tuberculosis, puerperal fever, scarlet fever, septicæmia, etc.; pneumococcus antitoxin, for the cure of pneumonia; antirabic virus, for the prevention of hydrophobia.

It is in the practical application of the products of the laboratories that their effectiveness is demonstrated. This is probably best seen in the treatment of diphtheria by antitoxin. The number of deaths caused by this disease have been reduced over fifty per cent since the use of this remedy was inaugurated, and it is needless to add that it has also been robbed of many of its most appalling features.

The department has diagnosis laboratories, where the bacteriological diagnosis of diphtheria, tuberculosis and typhoid fever is made.

During the year 1896, 25,049 cultures were examined for diphtheria bacilli; 1,856 specimens of sputum from cases of suspected tuberculosis were examined for tubercle bacilli; 16,796 vials of diphtheria antitoxin were issued; 918 cases of diphtheria were treated in their homes by the medical attaches of the laboratories, and 1,214 persons were immunized.

The diagnosis laboratories are of great benefit to the physicians of the city, in confirming their diagnoses. They are utilized by the physician in the following manner: A case of diphtheria, for example, occurs in the private practice of a physician; he makes a culture from the throat of the affected person, and sends it to the laboratory for examination. The day following that on which the culture is made he receives a report from the laboratory, which states whether or not the diphtheria bacillus is present. Stations are located at convenient places throughout the city, where physicians can obtain the culture tubes and where they can leave the tubes after the culture has been made. Collections are made from these stations every afternoon. In the cases of tuberculosis and typhoid fever the suspected discharges are sent to the laboratories in the same way, and are examined there bacteriologically.

A special corps of inspectors is assigned to the administration of diphtheria antitoxin, and, on request, one of these inspectors will visit a person suffering from diphtheria in any part of the city, day or night, and administer diphtheria antitoxin, under the supervision of the attending physician.

Dwellings and tenement houses where tuberculosis exists are under sanitary supervision and, as occasion calls for, are inspected and disinfected. There were over ten thousand inspections and disinfections for this disease alone in the year 1897. A number of tenement houses which were unfit for habitation, on account of their bad sanitary condition, have been condemned and torn down.

The disinfecting plant of the department is equipped with the necessary appliances to meet the needs of a city of the importance of New York. It is provided with apparatus for disinfecting by dry heat, steam, formalin gas and sulphur. Medical supervision of the public schools is exercised to the extent of keeping contagious diseases out of them.

Food products are kept under close watch, so that, as fas as possible, the people are given the benefit of only the purest and best. Milk cows in the city have been inspected, for the purpose of ascertaining the existence of tuberculosis among them, and where cows have been found affected with this disease they have been removed from the herds.

Horses suffering from glanders are also removed to places where they do not become a source of danger to other animals.

Investigations made by the department, showing that the dust in the street cars and various public places is often infectious, led to the enactment of an amendment to the Sanitary Code prohibiting spitting on the floors of street cars, ferry boats and other public conveyances, and requiring that all companies should post in their cars, boats, etc., printed notices forbidding this.

It is safe to assume that New York is as jealously guarded in the matter of public health as any city in the world.

EXCAVATIONS AT BRANCHIDÆ.

The Archäologischer Anzeiger contains in its current number (1897.2) a letter of great architectural interest from M. Haussonllier respecting the excavations on the site of the Branchidæ Temple of Apollo at Delphi. Some account has already appeared in the Bulletin de l'Académie des Inscriptions et Belles Lettres, January 15, and M. Haussonllier's letter to the Anzeiger is supplementary to this. It is illustrated by a photographic view of the front of the temple as at present disengaged. M. Haussonllier reports as follows:

The whole of the principal façade of the temple is now laid bare. It stood on a basis of seven steps, further subdivided to form an approach of thirteen steps, extending over the five central intercolumniations. This approach was shut in north and south by two pylons placed against the thirteenth column, starting from the angle column. These pylons, therefore, stand exactly where the line of the cellar wall, if produced, would fall. They would seem to have been intended to serve as bases to sculptural groups never actually erected. The principal facade of the temple was never completely finished. Both the steps near the pylons bear mason's marks, which would have disappeared in the final process of finishing. The facade consisted of ten columns, not one of which is standing. Of the bases of these columns, two were taken to the Louvre by Rayet and Thomas in 1873; the remaining eight have now come to light.

Like the steps and pylons, none of the bases are completely finished off. The bases are richly ornamented and pure in style, but unquestionably the most interesting point is the peculiar and so far unique character of the capitals. These are decorated with two heads of divinities, each taking the place of a volute; between the two heads in the middle of the capital is the head of a bull. This last feature has, of course, appeared before in Greek capitals, but no example hitherto has been known of the head of a god as a decoration to a capital. The two gods represented in the Didymaean capitals are Apollo and Zeus; one head of a bull has also been found. All three heads are fine specimens of decorative sculpture—large and impressive in style, and recalling in some respects the Pergamene school. The frieze also was adorned with sculptures of similar character, including a series of heads of Medusa—one placed above each capital.

A number of inscriptions complete the architectural interest of the excavations, among them a record of the expenses incurred in the erection of the temple. From these inscriptions we learn the regulations in force during the building and many of the architectural terms employed, and more important still, the date of the temple; the work of building was in full course in the middle of the second century B. C. Altogether the Didymaean Temple forms now an important chapter in the history of Greek architecture.—Architecture and Building.

THE CURRENT SUPPLEMENT.

The current number of the SUPPLEMENT, No. 1154, contains a number of articles of prime importance. "Chief Joseph and the Nez Percé War" describes some interesting events in connection with the recent Indian wars. "The Lateen Ice Boat," by H. Percy Ashley, describes the construction of a speedy ice craft. It is accompanied by full working drawings and particulars which will enable the amateur to construct such a boat. This article is published in response to many inquiries which we have received from our readers. "The Italian Marble Mountains of Serravezza" is the subject of a most interesting and unusual article. These quarries were opened at the beginning of the sixteenth century by Michelangelo, but could not be worked in his time by reason of lack of means of transportation, but at the present time the quarries are producing marble which is superior to that of Carrara. "The Trans-Mississippi and International Exposition at Omaha" is an article which describes the new exposition which will open June 1, 1898, and will continue open for five months. It is illustrated by a bird's eye view and illustrations of some of the buildings. "The Philosophy of Hyper-Space," by Prof. Simon Newcomb, is an interesting address. "The Liquefaction of Air and the Detection of Impurities (Separation of Helium from the Gas of the King's Well, Bath)" is an article by Prof. James Dewar.

G. D. BRILL, the Cornell graduate recently appointed director of a model farm and agricultural school at Wuchang, China, by Viceroy Chang Chi Tung, has now been appointed special Commissioner of Agriculture to China by Secretary Wilson, of the United States Department of Agriculture.

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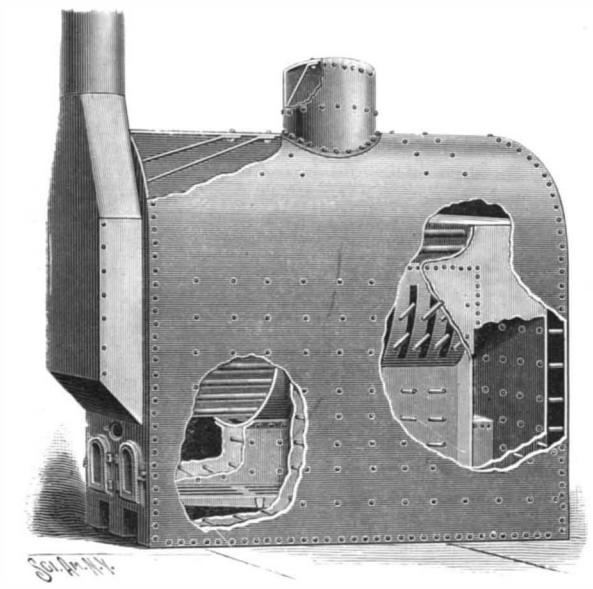
AN IMPROVED STEAM BOILER.

The illustration represents a double fire box return tubular boiler, having a continuous water leg all around and a center leg extending from water end in front to water end in rear. The boiler shown is designed to be 7 feet long, 7 feet wide, and 9 feet 3 inches high, with 300 2-inch tubes and a double fire box affording 30 square feet of grate surface. The improvement has been patented by Melvin De Puy, of No. 19 South Street, New York City. The shell of the boiler is made in upper and lower sections, the upper section being turned downward at the sides to form the outer walls of the side water legs, while the lower section, of somewhat thicker metal, has transverse slots providing communication between the interior of the shell and the side water legs, which, as well as the central leg and the steam section, are braced by stay bolts, as indicated in the broken away portions of the engraving. The crown sheets over the fire boxes, being cylindrical, require no bracing. The spaces between the center water leg and the side water legs are employed as fire boxes, there being at the rear a flue box, through the flue sheet of which extend horizontal flue tubes terminating at the front header. Somewhat more space is provided between the tubes directly over the central water leg, thus promoting the free circulation of water over and through such leg, and, the ends of the side and center water legs being open, the several legs practically form one continuous water leg. It is designed that there shall not be an inch of heating surface wasted or unutilized in this boiler, that all parts may be easily kept clean and readily accessible in case repairs are needed. Although especially adapted for a marine boiler, for tugs, yachts, etc., it is also suitable for use for stationary purposes. The invention has also been patented in Canada.



DE PUY'S STEAM BOILER.

Utilization of Old Magazines.

What to do with the magazines that crowd upon our tables in ever-increasing numbers is coming to be a serious problem, says a writer in The Evening Post. It probably is not an exaggeration to say that eight or ten periodicals in magazine form come each month to the tables of every one of us who essays to keep informed as to the currents of modern thought. Nowadays it is in the magazine that we expect to find the newest if not the best outcome, not only of the strictly literary art, but of the most recent fruits of investigation.

Here, however, begins the problem that we have hinted at. What shall we do with this printed material after we have made our first perusal? The magazines may well lie upon the table for a few days, brightening the room with their gay covers, but in a week or so after the last one arrives another batch comes along to crowd the earlier ones aside, very likely before we have read the one particular article for which this and that number was bought. Most of all, the others contain something which is in the line of our study or hobby, or is too engaging in its treatment or illustrations to be thrown away without a struggle.

But magazines are bulky and of considerable weight. Our houses are usually small and shelf room is limited. Moreover, one does not like to put unbound pamphlets upon his book shelves. To bind all the magazines twice a year, however, means a very considerable expense; and, even if this in itself were not an objection, it would appear to almost everybody that he was paying out his money and taxing his shelf room for much that was not then, nor ever would be, of any value to him. It is probable that, leaving out of account three or four of the foremost magazines, it will rarely happen that more than two or three articles in a single number of any of our current periodicals will appeal to any one man as worth saving. On the other hand, it will be rare that a month's issue will appear in which something does not present itself as valuable for future reference and desirable to save.

The solution of the problem consists in tearing the magazines to pieces and binding the separated articles together again, forming selected volumes, each containing what relates to a more or less limited subject—not too limited, unless you are willing to wait a long time to complete a volume.

We find that it is an easy matter to rip off the advertising pages from a magazine by grasping the whole mass of them in the right hand, holding the remainder of the volume firmly with the left, when a sharp jerk will bring away the advertisements without tearing, and at the same time will straighten out the wire stitching that binds the volume. The separation and removal of the remainder of the magazine, signature by signature, is after that a very simple matter, requiring only manual care and the aid of a paper knife. This usually becomes the employment of an otherwise idle evening, when a dozen or even twenty magazines can be disposed of without overtaxing one's time or patience. The rejection of the principal part of the undesirable material goes on as you pull each number to pieces, and your waste basket will fill up rapidly. A second culling will take place later.

Each article, as it is separated from the mass, should be marked (preferably with a lead pencil) with the name of the periodical from which it has been taken, and its date; and should be pinned, to prevent its leaves from going astray. Frontispieces often go with an illustrated article, and should be attached to it at this stage, when, also, extra illustrations may be placed next to it or between its leaves, if they are at hand.

When a hundred or so magazines have been thus treated, an evening may be devoted to going over the pile of articles saved, sorting it out into classes, and preparing the volumes for the binder by arranging the matter in the order in which you wish it bound, removing the pins and placing the pages in an even and careful pile to the amount of each volume.

From fifty to seventy-five articles can be put into a single volume. The more minute one's classification the longer, of course, he will be in acquiring the necessary number of articles to make each book—perhaps two years. The binding of the whole series should be uniform, but this is a matter of taste, and some persons may prefer to make only uniform those volumes which follow one another upon the same subject.

It will often happen—though not so frequently as would seem probable—that two articles upon different subjects, and to go into different volumes, may be printed so that the last page of one is upon the back of the leaf of the first page of the next. In this case, of course, one is obliged to sacrifice one or the other of these pages, but these cases do not occur often enough to cause serious annoyance.

Each man's classification will, of course, depend upon his tastes and pursuits, and each one will throw away a great deal of matter that his neighbor would preserve. It would be an excellent plan, therefore, for two or more families to pool their magazines and select from the mass what each one cared to keep. Undoubtedly this would tend to some cheerful battles, but this would lend interest to the pursuit, cultivate powers of argument, and endow the result with a personal interest which otherwise it would not possess.

Such a collection of bound magazine papers will grow year by year into a more and more valuable adjunct to a library, whether regarded as a means of reference or of recreation. A large number of handsome illustrations can be kept, scattered among the literary material, either with or without any accompanying text, which would otherwise be thrown away. Lastly, this becomes a practicable method of preserving continued stories and series of articles such as are continually published in the magazines, which by this means are brought together into continuity and become a book. This will often be found to have a bibliographic value, because differing in some interesting way from the form in which the matter is subsequently reissued as a book. An interesting instance is "Trilby," which in its parts brought together, as it appeared in Harper's Magazine, contains several features not to be found in the republication.

The Telephones of the World.

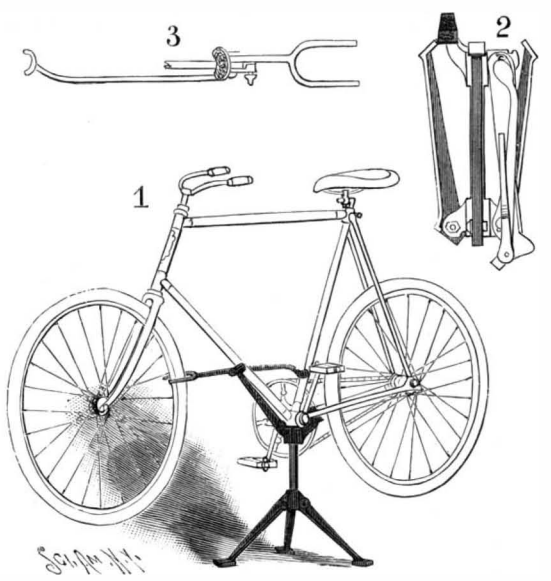
Electrical Engineering, of Chicago, publishes the following list of the number of telephones in use in various countries. It is compiled, says our contemporary, from the latest statistics.

Angola, Province of	200	Hungary	10,000
Austria	20,000	Italy	14,000
Australia	2,000	Japan	3,500
Bavaria	15,000	Luxemburg	2,000
Belgium	11,000	Norway	16,000
British India	2,000	Portugal	2,000
Bulgaria	300	Roumania	400
Cape of Good Hope	600	Russia	18,000
Cochin China	200	Senegal	100
Cuba	2,500	Spain	12,000
Denmark	15,000	Sweden	50,000
England	75,000	Switzerland	30,000
Finland	6,000	Tunis	300
France	35,000	United States	900,000
Germany	140,000	Wurtemberg	7,000
Holland	12,000		

The total number of subscribers represented in this list is 1,402,100.

A SUPPORTING STAND FOR BICYCLES.

To support bicycles for display or other purposes, the accompanying illustration represents a simple and strong device that may be quickly adjusted to suit different forms of bicycle frames, and which may also be compactly folded for transportation or packing, Fig. 2 showing the device in its folded position, Fig. 1 representing it in use, and Fig. 3 illustrating a plan view of a portion of the support. The improvement has been patented by Edward H. Webster, No. 13 Evergreen Avenue, Rutland, Vt. The main post has three folding legs, and on its upper end is a saddle on which may be seated the lower brace bars of the bicycle frame, there being opposite the saddle a projecting ear to which is pivoted a supporting arm carrying a bracket and screw, designed to engage a notch in the ear, by means of which the pitch of the arm may be regulated to the pitch of the front brace bar of the bicycle frame, which the upper end of the arm is forked to engage. Pivoted on the upper end of the arm is a locking bar having a forked end to engage the center brace bar of the bicycle frame, and also a forked arm designed to engage the tire of the front wheel, the parts being held in adjusted position by a locking bolt, whereby the bicycle cannot be accidentally dislodged from the stand.



WEBSTER'S BICYCLE STAND.

A SEAL AND TAG FOR RAILROAD FREIGHT CARS.

The illustration represents an inexpensive device for convenient application to the doors of railroad freight cars, to seal the car, preventing its being accidentally opened and unauthorized abstraction of the contents. The improvement has been patented by Edgar De Lamater, of Ogden, Utah. The device is formed of a single strip of metal, the strip having at one end bent over edges or lips to form a passage, as shown in the small view, through which may be passed the other end of the strip, when the device is placed in position to seal the car door. After this has been done, the bent over edges and the end or tag portion of the strip are passed between the dies of a plier or similar tool, producing the crimps or corrugations, as shown in the large view, and providing the tag with embossed characters indicating the number of the seal, etc. It is evident that the parts thus securely locked together cannot be separated without breaking the seal and insuring immediate detection.

DE LAMATER'S CAR SEAL AND TAG.

VINEGAR flavor consists of the following mixture: 5 tarragon oil, 250 pear ether, 250 raspberry ether, 50 acetic acid, 100 cognac essence, 5 vanilla essence, 350 90 per cent spirit. This is added to the vinegar according to taste.—D. Drog. Ztg.

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THE FLUOROMETER.

Surgeons know how quickly the hope sprang up after the discovery of the X rays that that new discovery might be utilized by surgeons in the diagnosis of foreign substances in the human organism; and it is also well known that, while many brilliant operations have been performed with their aid, it was very early found that, wherever a foreign substance which was less permeable than its surroundings might be, it was certainly not in the position indicated by the so-called "shadowgraphs," and as a consequence two views taken at right angles would not disclose the location of the object. In attempting to make practical use of the Roentgen rays in the discovery and location of a foreign substance in the body, surgeons were at once confronted with the fact that the visible effect of the Roentgen rays, either on its action on the sensitive plate or paper, or its visular effect on the fluorescent screen, was a shadow and a shadow only, with all the limitations that the term implies. The surgeons found that this shadow (after the nature of shadows) was treacherous and unreliable. In other words, a positive change in the position of the patient will be marked by far less change in the general outlines of the shadow of the subject, while the shadow of the inclosed object was greatly distorted; thus producing a distortion in the picture which added a great element of uncertainty as to the exact location of the object sought with reference to any points on the subject.

Then there was the distortion caused by the angle of the rays. It was at once realized that, if this shadow was to be an aid in surgery, the distortion caused not only by the angle of rays but by the position of the subject must be eliminated. By repeated experiments it was found that locating a substance in another substance which was more permeable, by using right angles, was apt to produce unreliable results which would be likely to remain so until what, for want of a better term, may be called a "correct shadow" could be found, and then retaining the same relative position, a second angular view be taken. It must be remembered we are dealing with a shadow which is not only treacherous but is lacking in dimension of thickness.

Further investigation showed that the only practical solution of the difficulty was to establish a definite cross section of the patient or the limb by means of angle pieces, which would be less permeable than any portion of the subject and which could be made to retain their relative position to the subject and with the parallelism of the rays through the process of producing the angles. After long experimentation, an appliance was perfected which conforms in a general way to the shape of the body and at the same time preserves the position of the body squarely in its relation with an adjustable table.

The function of the instrument which we describe is to establish with precision the location of any foreign object within the human organism which is impermeable or comparatively so to the X rays. In other words, it is the province of the "fluorometer" to enable observers to form an exact and certain diagnosis of the presence of bullets, needles, calculi or any other substance which is comparatively more dense in its fluoroscopic shadow than the subject in which it is contained. It is also its function, by eliminating the distortion of position and the distortion caused by the divergence of the rays, to provide the surgeons with absolute and reliable measurements in case of dislocations, fractures or any abnormal conditions of the anatomy which are susceptible of reproduction in the Roentgen ray shadow.

It is a feature of prime importance in the fluorometer that the observations, diagnosis and measurements are made without the aid of photography, while at the same time, in case it is desired to preserve a record of the existing conditions. the fluorometer admits of producing in the form of a fluorograph exactly the conditions, including the measurements, which were shown by observations with a fluoroscope. It is hardly necessary to dwell upon the importance of this instrument as an adjunct in the use of the Roentgen rays in surgery. It is extremely ingenious from a scientific point of view, and we are indebted to the Rochester Fluorometer Company, of Rochester, N. Y., who are the makers of the Dennis fluorometer, for the particulars which we present to our readers.

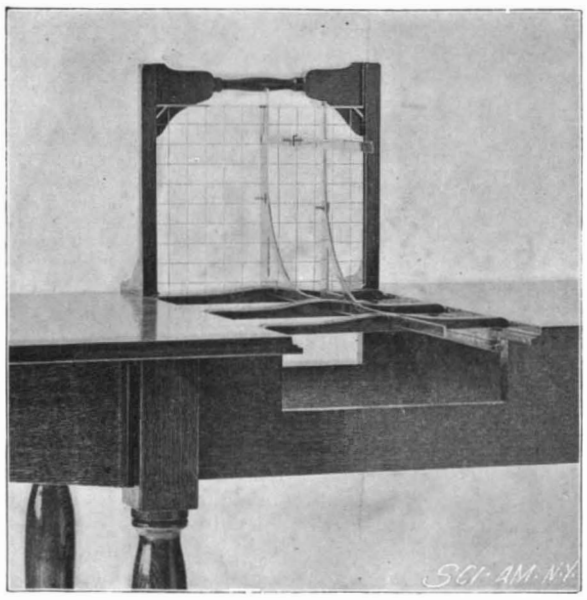

Fig. 1.—THE FLUOROMETER—TABLE AND GRATING.

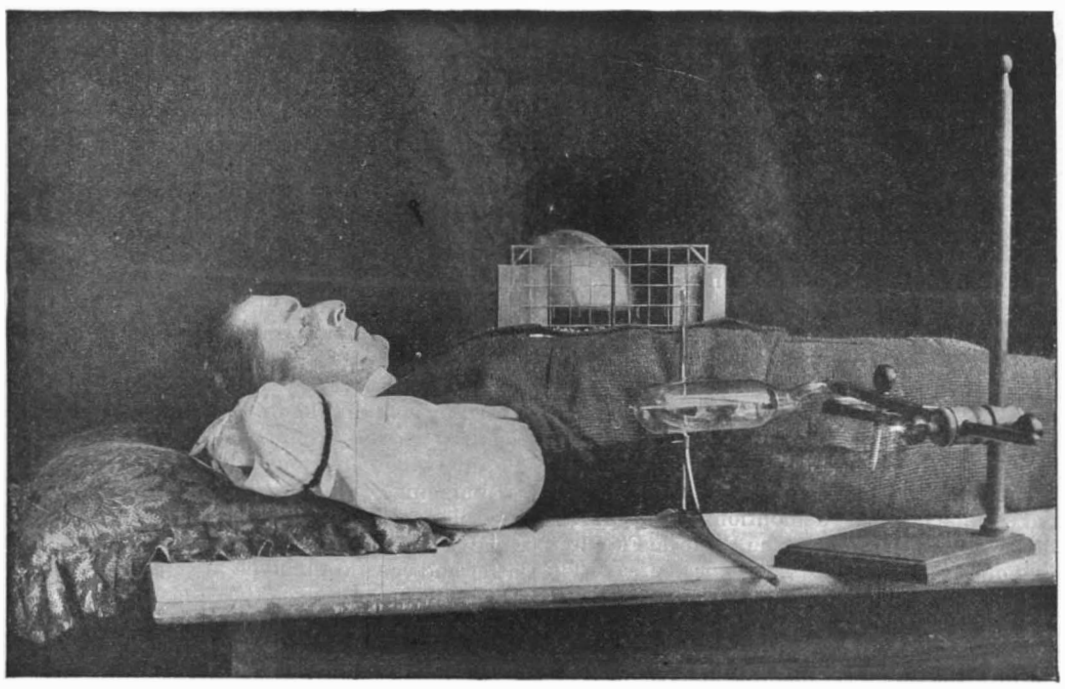

Fig. 2.—THE FLUOROMETER IN USE.

The fluorometer consists of a set of metallic angle pieces which in their use with the X rays are capable of being squared with an adjustable table. The patient is laid on the table, Fig. 1, and a fluorometer appliance is adjusted as shown in Fig. 2. The fluorometer is brought with the body into parallelism with the rays; that is, when the proper position of the cross section is obtained, the two arms of the fluorometer will present a characteristic single shadow on the field of the fluoroscope. Adjustable to the arms of the fluorometer are two pins or sights shown in our view of the table. By means of these sights, the foreign object having been brought in line with them and the proper adjustment having been made, a correct line is produced with the sights and the foreign object coincident. Attached to the table is a metallic grating with meshes of exactly one inch. This grating when in position is square with reference to the table upon which the patient is placed, and the normal position is close to the side of the patient opposite to the source of the energy. The fluoroscope is placed against this grating, and it will be seen at once that measuring from any point desirable on the surface of the patient to the foreign object is but the matter of a moment. The movable pins on the arms of the fluorometer now come into use. These pins are placed equidistant from the base of the fluorometer, which is of course squared with the table; then, when the table with its patient is adjusted so that the pins or sights coincide with the foreign object, it will be known that all three are in the parallelism of the rays, and that the characteristic distortion caused by the angle of the rays has been eliminated, and the measurements taken with the eye, by means of the metallic grating, will thus enable the surgeon to chart unerringly the position of the foreign object with reference to the surface of the body which contains it.

How far "in" from the surface of the body it may be, however, is at this point a mystery. Now, without moving the patient or disturbing the position of the fluorometer, the second observation is taken. For convenience in using the fluoroscope a section of the top of the table is removable, as shown in our first engraving, and a proper fluorometric appliance substituted by means of which the second right line of the right angle is determined. The aperture in the table is also provided with the metallic grating and the fluorometer is provided with an attachment which closes the side of the instrument which was opened during the first observation. When the surgeon takes a position below the table, he obtains a view which is exactly at right angles with the first. The pins are again brought into use, and the table, patient and fluorometer together brought into parallelism with the rays, the tube having now been placed over the patient. It will be seen at once that, while the first operation locates the foreign object on an exact cross section, the second observation shows the exact position occupied by the foreign object in that cross section. The position of the foreign object again with reference to the points on the cross section of the subject and with reference to certain points on the fluorometer is at once charted by the aid of the meshes of the metallic grating. Necessarily, the foreign object must be situated at the point where the two lines coincide. All the elements of distortion have been eliminated—both the distortion caused by the position, also the distortion caused by the angle of the ray. Where the point is can, of course, be at once ascertained by measurements on the surface of the body.

In practice, the surgeon indicates the first cross section obtained by a line of India ink or iodine on the body, and is thus enabled to establish the position of the object by measurements from points on the exterior of the subject with as much exactness as if the body or limb were actually severed at the first cross section and presented to view. If it is desirable to preserve a record of the observations, all which is necessary is to produce a fluorograph by substituting the sensitive plate for the field of the fluoroscope back of the grating and making the necessary exposure.

In the case of a bullet in the brain cavity, elements of uncertainty of location, having in view the desirability of a possible operation for its removal, become very

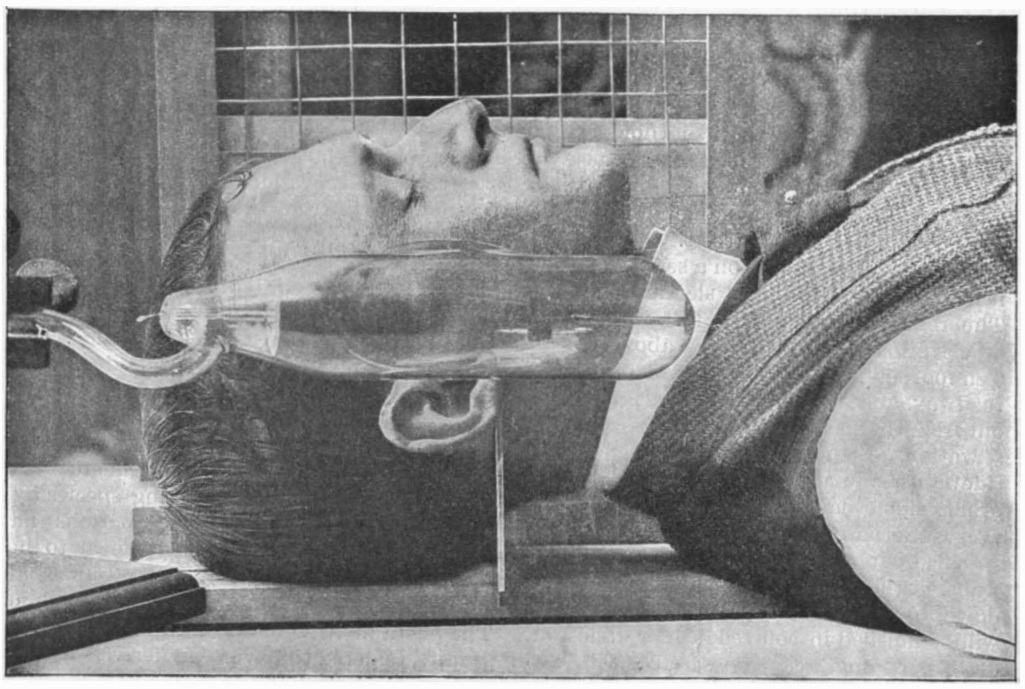

Fig. 3.—LOCATING A FOREIGN BODY IN THE BRAIN CAVITY WITH THE FLUOROMETER.

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grave. After what has been said about the nature of the Roentgen shadow, it requires no argument to show that a very slight variation of the position occupied by the head would produce a distortion which would preclude successful exploration. By means of the fluorometer the position of a foreign object in the brain cavity is ascertained with precision, as in the case of the body already given. It becomes merely a matter of cross sections and surface measurements, a definite base line being at the service of the surgeon. Our third engraving shows the method of using the fluorometer on the head.

THE RIVERSIDE DRIVE VIADUCT, NEW YORK.

The handsome steel viaduct now in course of erection across Manhattan Valley, which latter runs in a general east and west direction in the neighborhood of One Hundred and Twenty-ninth Street, New York, is intended to form a connecting link between the Riverside Drive and the newly constructed Boulevard Lafayette.

The Riverside Drive is the main thoroughfare through the famous Riverside Park, a strip of ornamental park land extending along the lofty banks of the Hudson from Seventy-second Street to Claremont, in the neighborhood of One Hundred and Twenty-seventh Street, a distance of two and three-quarter miles. Here the ground falls somewhat abruptly to One Hundred and Twenty-ninth Street, and the drive swings around the brow of the hill, forming a loop by which horsemen and vehicles can return.

The Manhattan Valley has a width of about a quarter of a mile and is intersected by six different streets, one of which constitutes the main approach to the Fort Lee ferry and is traversed by horse and cable car lines, the latter feature alone rendering the valley unsuitable for the construction of an intersecting public driveway. At the north end of the valley the ground rises abruptly to the Washington Heights, a ridge or tableland which extends northward between the Harlem and Hudson Rivers to the extreme limits of Manhattan Island. At One Hundred and Fifty-seventh Street a handsome driveway, known as the Boulevard Lafayette, diverges to the left from the Boulevard—the main driveway of New York, practically a continuation of Broadway—and follows the lofty banks of the Hudson River for a distance of three miles, or nearly to the northern limits of Manhattan Island. Both this boulevard and the Riverside Drive to the south of it are rich in features of natural beauty. Following with easy curvature the bluffs of the lofty river banks, they give a broad outlook upon the waters of the Hudson River, the frowning cliffs of the Palisades and the distant hills of New Jersey. Among the many handsome drives in suburban New York these are, in some respects, the finest—certainly they are the most unique.

The handsome viaduct which forms the subject of our front page engraving is being built for the purpose of connecting the two drives and affording a continuous high level boulevard from Seventy-second Street to the west end of Dykeman Street, a distance of seven and a quarter miles. The latter street is practically the northern terminus of the Harlem River Speedway, which will shortly be opened to the public, and when this is completed it will add another three miles of spacious roadway, thus providing a continuous drive of ten miles along the picturesque banks of the Hudson and Harlem Rivers. An illustrated account of the Harlem Speedway will be found in our issues of February 6 and 13, 1897.

The viaduct has been designed with a view to harmonizing its appearance with the surrounding natural and architectural features. Including the masonry approaches at either end, it will be 2,074 feet in length. The southern approach is located just below Claremont, a villa rich in historic interest, and immediately to the south of Claremont rises the majestic pile of the Grant Memorial Tomb. The viaduct connects with the Riverside Drive at the center of the loop by which the latter encircles the northern span of the high land on which the drive is located. The entrance will be carried on a masonry approach 262 feet long, which includes a stone arch span across one of the east and west streets. The steel structure, 1,564 feet long, is carried on a series of steel arches of 65 feet span, supported on slender steel lattice piers. The roadway, which is 60 feet in width, is built at an elevation of about 70 feet above the ground level. Ten-foot sidewalks are provided on each side of the roadway, and at regular intervals balconies are built out from the footways to afford places for rest and observation. Elaborate scroll railings will protect the sidewalks, and upon these will be placed thirty-six ornate cluster lamps, a pair of lamps being placed over every alternate pier. The southern entrance will be widened out and bounded with semicircular parapet walls, at the center of which stone staircases will lead down to the lower level of the valley. The masonry will be finished in coursed ashlar limestone. The pedestals, copings, capstones, etc., will be of granite, hammer dressed.

The semicircular arches of the viaduct will be of plate girder construction. They will be 3 feet in depth and will have a riveted connection to the tops of the steel columns. The latter will be oblong in section, measuring about 3 feet by 5 feet, and of latticed plate construction. The plating of the columns will be carried up between the spandrels of the arches to the level of the floorbeams, where it will finish off against a continuous cast iron fascia plate which will form an ornamental cornice below the footwalks. The spandrels will be filled in with vertical posts which will transfer the load of the floorbeams to the arches. These posts will be stiffened by light semicircular struts. The floor will be carried on floorbeams 5 feet in depth, of which there will be six to each span, and upon these will be thirteen rows of 12-inch longitudinal I-beam floor joists. The crowning of the roadway will be secured by placing cast iron blocks of varying depth between the joists and floorbeams. Above the joists will be a solid floor of riveted ⅜ inch buckle plates. The sidewalks will be carried upon brackets of ⅜-inch steel plate, and covered with corrugated iron floor plates. The plating of the roadway and sidewalks will be covered with a paving composition of coal tar residuum and broken stone and upon this will be laid the asphalt surface.

The structure is designed to carry a moving load of 100 pounds on every square foot of roadway and sidewalks, and 10 pounds per foot is allowed for snow and slush. In addition to this, provision was made in designing the steel work for the following concentrated loads: Twenty tons on two axles of a wagon or truck spaced 12 feet apart, the wheels being 5 feet apart. The roadway must be able to sustain this load safely at any part of the viaduct. The wind pressure is calculated at 500 pounds per lineal foot. The contract price of the structure is $570,000.

It will be seen from our engraving that the viaduct will present a bold and yet graceful effect, and will be thoroughly in harmony with its surroundings. The point of view is supposed to be from a position above the Hudson River to the south of the Grant Memorial, and we are therefore looking in a northeasterly direction. The easterly brow of the Washington Heights is easily recognizable, and beyond it may be traced the course of the Harlem River, while on the distant horizon are the wooded hills of Long Island. To the west of the viaduct is the Fort Lee ferry and its adjacent wharves and along the base of the bluffs at tide level are the freight tracks of the New York Central Railroad.

The plans of the structure were drawn by Mr. Francis Stuart Williamson, M. Am. Soc. C.E., of this city, to whom we are indebted for the data from which the present article was prepared.

Recent Archæological News.

After more than twenty years of discussion, and in spite of the systematic opposition of the military engineers, the French government is submitting to Parliament a scheme for the demolition of the fortifications of Paris from the Seine to the Porte de Flandres, a stretch of about eight miles. It is expected, says The Builder, that the Chamber will ratify the proposal, which will be of great service to Paris, in removing a boundary which stands in the way of free extension of the city, while it is no longer of value as a fortification, and, in fact, counted for nothing in the defense of Paris in 1871. In its place (if removed) a grille or wall of some kind will be erected, in order to recognize the rights of the octroi; and around this it is proposed that there should be a zone of public squares and new roads, which will probably have the satisfactory effect, among others, of lowering house rents in Paris.

The new year will hardly have got well on its course when to the Doges' Palace in Venice will be restored the great lion, erected there by Doge Andrea Gritti, who ruled from 1523 to 1538. To Gritti belongs the honor of restoring to Venice all the possessions she had held before the League of Cambrai. Gritti's monument was this lion, set up before the middle gallery of the palace on the west side, twenty-three meters from the ground. After the fall of the Venetian oligarchy vandals swept the lion away. The restored work, from the sculptor Urbano Bottasso, represents a majestic beast, at whose side kneels a doge in robes of state.

The record of the antiquity of domesticated dogs does not even stop with the earliest known Egyptian monuments, says Knowledge. Not only were such breeds known in Europe during the iron and bronze ages, but also during the antecedent Neolithic or polished stone period. These have been described by Profs. Rütimeyer and Wöldrich, and those who are acquainted with the difficulty of distinguishing between some of the living species by their skulls alone will understand the laborious nature of the task. Still these authorities appear to have made out that the Swiss, Neolithic dog (Canis palustris) had certain cranial resemblances to both hounds and spaniels, and thus indicated an advanced type, which is considered to have been derived from neither wolves nor jackals, but from some species now extinct. Two other breeds have also been recognized from the superficial deposits of the Continent; and if, as is very likely to be the case, any or all of these races are the forerunners of some of the modern breeds, it will readily be understood how complex is the origin of the mixed group which we now call Canis familiaris.

Cleaning Old Oil Paintings.

Long articles can be found on this subject in a great many books, of which the commencement has already been forgotten when the end is reached. If one desires to clean old oil paintings, the first thing to be done is to find out the cause of the darkening of the picture, and according to this the remedies are applied.

It is obvious that the darkening of the picture must primarily be ascribed to the dust which has accumulated upon it and to the products of bad combustion, soot and its companions, and these parts one must always first strive to remove, which is either done with water or with soap and water (best fat soap). This will generally also take off some of the accumulated smoke which has covered the picture with a brownish-yellow veil and which is removed with spirit of sal ammoniac, diluted with twelve parts rain water, whereby the former is sufficiently thinned so as to be perfectly harmless to the oil paint, while it is still strong enough to dissolve the smoke; whether it will do the work if still more diluted can be readily ascertained by experiments.

If this does not render the picture lighter, it has usually been varnished, in former times, over the accumulated dirt and smoke and frequently, in the case of old pictures, with a very fat copal varnish, i. e., one rich in oil, which became quite dark yellow itself, through age, and underneath which lies another smoke film. This layer is one of the worst. It may be removed in various ways, but great caution is necessary. If the picture is not too large, the varnish may be dissolved by alcohol vapors and removed with a turpentine wad. For the former purpose place pieces of cotton or linen cloth upon a glass or metal plate, saturate them with alcohol and lay wooden strips about 2 to 3 centimeters (¾ to 1¼ inch) high around, and upon this the picture with the face downward. The spirit vapors soon soften the varnish, and when this is done it is taken off with turpentine. Care must be taken that the oil paint is not softened and taken off at the same time. Or mix two parts of turpentine to about one part of spirit; pour the mixture into a bottle which has a fine tube leading through the cork and sprinkle some of it upon the picture, whereby the oldest varnish will be dissolved in a short time. Soft colors, such as the blue of the sky, covered flesh tints, draperies, etc., are less apt to be attacked by this tincture than the glazings in the shadow sides, and particular caution should be exercised here. Fortunately, these can be easiest restored by a skillful hand. After the varnish has been removed there is frequently still some smoke on the picture, which must be taken off with the first-named sal ammoniac water, using clean water to rinse off with.

In place of the last mixture one may be prepared of copaiva balsam and spirit in equal parts, or of the latter and caustic ammonia in equal parts. The latter will likewise dissolve the varnish, although more slowly, which is no disadvantage, however. The ammonia will at the same time dissolve the soot.

When the picture is clean it is saturated with oil, which is allowed to soak in for a couple of hours; then all that has remained on the surface is carefully wiped off with cotton wool and a little powdered starch. No oil should stay upon the colors, because it will turn yellow in a short time and render the picture dark again.

For revarnishing the picture, we have found most suitable a thin dammar varnish, as it does not darken and can be readily removed.

Repainting or restoring pictures with colors is the most difficult job of all, and, if possible, recourse should be taken to erasing and then cleaning the spot under which there was still dirt.

For renovating, lakes of dammar varnish with a little oil are best suited, as they do not become darker to such an extent as oil colors.—Translated from the Maler Zeitung.

Influence of Wealth on Mortality.

On the influence of wealth on mortality, the Breslau statistician, Neefe, publishes an interesting paper in the Zeitschrift fuer Hygieine und Infektions Krankheiten. As a criterion of the means, the amount of the rent paid was taken. In 1896 there died of every 1,000 living persons who paid a rent up to 300 marks, 20·7; with a rent of 301 to 750 marks, 11·2; the rent ranging between 751 and 1,500 marks, only 6·5; the average being 17·6 persons. While according to these figures the mortality of the Breslau poor population is three times as large as that of the rich, it is in reality much larger, because the deaths not included therein (servants, journeymen, persons who died in the hospitals, etc.) may be assumed to belong almost exclusively to the first class. The greatest difference in the mortality was, of course, shown by the babies; more than half of those born alive belonging to the poor population died in babyhood, while the deaths of babies of the rich amounted to only one-sixth.

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Correspondence.

"Tapping the Rock for Water."

To the Editor of the SCIENTIFIC AMERICAN:

I read with interest your article in last week's issue, "Tapping the Rock for Water," showing how pure water has been obtained from the granite rocks along the coasts of Norway, despite the old geological theory that water cannot be found in granite.

You say, "The boring in hard rock would probably have the same result in other countries." Let me tell you the result here in South Carolina:

This town of 5,000 inhabitants is built over granite. The stratum is from 15 to 50 feet beneath the surface. Recently we became suspicious of water from shallow wells, because of the danger of surface drainage and contamination; and, there being no convenient stream from which to get a supply, an artesian well was suggested. Notwithstanding the old theory against water in granite rock, the work was undertaken by the advice of Prof. Powell, an up-to-date geologist of our college.

The first 40 feet was through clay and loam; then a hard granite rock was struck. The drill was kept going for weeks. At the depth of 285 feet a stream was struck in a crevice of the rock. Every inch of the way, except the first 40 feet, had been through solid granite, and only the short segment of 40 feet required to be curbed. A test was made with a steam pump and the minimum flow was found to be 200,000 gallons a day.

The water stood within 3 feet of the surface, on a steep hillside. A trench was cut, and for several months before the waterworks were completed it was a flowing well.

We have now an excellent system of waterworks with an abundant supply of water absolutely pure and wholesome—not simply wholesome, but possessing valuable medicinal properties, containing, among other ingredients, lithia and sodium sulphate.

The experience here has been repeated, under similar circumstances, at Chester, 50 miles away, and at Laurens, 30 miles.

Artesian wells have solved the question of pure water in South Carolina; not only in the marshy, malarial seacoast country—where fevers have been reduced more than 30 per cent—but in the middle and upper sections also that rest on solid granite. W. H. W.

Newberry, S. C., January 24, 1898.

Prices for Works of Art.

The private or public sale of works of art by the great masters is always sure to awake great interest in the cultivated. In the "Almanach Hachette," for 1894, there is a table of fifty pictures which have sold for the highest prices in recent times. The largest price which a picture has brought was paid for Raphael's "Madonna Ansidei," which was purchased for the National Gallery of London by the nation for $350,000. The National Gallery also has the unique distinction of owning the second most expensive picture, a portrait of a man by Morone, which sold for $300,000. Next in order comes Jean-François Millet's "La Bergère," which was purchased by M. Chauchard for $200,000. The same collector is the happy possessor of the celebrated "Angelus," which was sold to him for $110,000. The Rothschild family have a number of almost priceless masterpieces. Edm. de Rothschild paid $160,000 for Rubens' "Jardin d'Amour;" he also purchased three of Gainsborough's portraits of women for $375,000. Alph. de Rothschild paid $120,000 for Raphael's portrait of Cæsar Borgia, and $250,000 for two works of Rubens. Gust. de Rothschild paid $150,000 for two works of Rembrandt. The late Duc d'Aumale purchased Raphael's "Three Graces" for $125,000, and Madame Guinness, of London, paid $240,000 for two works of Rembrandt. The Museum of the Louvre, Paris, purchased "The Assumption" by Murillo for $120,000. The portrait by Albert Dürer in the Museum of Berlin was acquired for $90,000. Munkacsy's "Christ Before Pilate" was sold for $100,000. Meissoniers bring enormous prices in relation to their size. The "1814" was acquired by M. Chauchard for $110,000; his "1807," now in the Metropolitan Museum, was bought for over $60,000. Van Dyck's portrait of the Marquise of Spinola was sold for $100,000. The National Gallery, at the sale of the collection of the Duke of Lansdowne, bought three works by Velasquez, Morone and Holbein for $300,000. There have been a number of other pictures sold for $60,000 or over, among them being Mr. Havemeyer's "Gilder," by Rembrandt, which cost $60,000. It is not often that a Raphael is on the market. At the present time the "Virgin with the Candelabra" is for sale. It was bought at the Monroe collection of 1882 for $100,000. If this second or third rate work of the great painter of Urbino is worth over $100,000, it is an interesting question to know what the market price of a masterpiece like the Madonna of San Sisto or the Madonna of Foligno would be.

IN Buenos Aires (Argentine Republic) and Para (Brazil) street cars are drawn by mules at a speed of ten miles and over per hour.—La Vie Scientifique.

Miscellaneous Notes and Receipts.

Autographic Ink.—Autographic ink is made by melting together the following substances: 10 parts soap (white grain soap), 10 parts wax, 3 parts tallow, 5 parts shellac, 5 parts mastic, 3 parts lampblack.

Formoform Powder.—This is recommended by the Crown Pharmacy, in Berlin, as a disinfecting remedy against perspiring feet. It is a white powder with a faint thymol odor, composed of 0·13 per cent of formaldehyde, 0·1 per cent thymol, 34·44 per cent oxide of zinc and 65·27 per cent of starch. Applied to wounds and purulent secretions, a great disinfecting power is said to be attained in consequence of the splitting off of formaldehyde.

Negative Lacquer.—1. Amber, 50 grammes; sandarac, 100 grammes; alcohol, 1,000 c. cm.; castor oil, 1 gramme. 2. (Hard negative lacquer.) Sandarac, 250 grammes; Venetian turpentine, 25 grammes; oil of lavender, 30 grammes; ether, 30 grammes; absolute alcohol, 665 grammes. 3. (According to Andres.) Sandarac, 150 grammes; oil of lavender, 110 grammes; chloroform, 20 grammes; spirit, 720 grammes. 4. (According to Andres.) Bleached shellac, 125 grammes; mastic, 25 grammes; oil of turpentine, 25 grammes; spirit, 885 grammes. 5. (According to Valenta.) Angola copal, 60 grammes; amber, 10 grammes; ether, 600 grammes; acetone, 100 grammes; chloroform, 20 grammes. 6. (According to Klaussner.) Dammar gum, 110 grammes; mastic, 7 grammes; benzole, 883 grammes.—L. Drog. Ztg.

Some Cosmetics.—The Seifen Fabrikant gives the following recipes:

Wash.—1 liter of distilled water; rice flour, ½ pound; violet powder, 135 grammes; glycerine soap, 10 grammes; bergamot oil, 6 grammes; and iris oil, 5 grammes.

Skin Gloss.—Potash, 50 grammes; spermaceti, 56 grammes; rice flour, 500 grammes; benzoin powder, 20 grammes; bitter almond oil as required.

Toilette Glycerine.—Glycerine of 20° B., 2 kilogrammes; rose water, 2 kilogrammes; sodium bicarbonate, 30 grammes.

Athens Water.—Calcium carbonate, 70 grammes: sassafras wood oil, 250 grammes; rose water, 4 liters; orange blossom water, 4 liters; spirit (96 per cent), 1 liter.

Cold Cream.—Almond oil, 500 grammes; white wax, 90 grammes; spermaceti, 90 grammes; rose water, 280 grammes; bergamot oil, 2 grammes; lemon oil, 8 drops; rose oil, 2 grammes.

Castor Cream.—Castor oil, 500 grammes; almond oil, 160 grammes; spermaceti, 65 grammes; geranium oil, 5 grammes; lemon oil, 5 grammes.

Mites in Sweet Wines.—For some time past there has been great excitement in the countries which produce sweet wines, says the Schw. Wein Zeitung, for it has been shown that a large number of mites are found in such wines as Malaga, Muscatel, Samos, etc. Up to the present it was believed that liquids, and especially alcoholic ones, were free from these animals and that mites only occurred on dry foods stored in dark and especially in damp rooms. Now this opinion must be discarded as erroneous, for the sweet wines do not contain isolated mites, but large quantities of them, full grown ones as well as numerous young, which shows that they multiply readily and quickly in the liquid. The mite discovered in the sweet wines is the Acarus passulorum, which is found on dried prunes, figs, etc. Examination of the wines infested with mites has on a whole not given a very bad result, inasmuch as the taste of the wine is not changed and its alcohol is not perceptibly decreased. The mite seems to subsist on the vegetable cells of the yeast, which it sucks out. It has also been established with tolerable certainty how the mites get into the wine. The name of Acarus passulorum, which has been given them, signifies mite of the dried currant, on which the animal is very frequently met with, as well as on the dried grapes which are used for making wine. In the wine made from the latter the mites are mostly found, as they pass from the dried grapes, which are often kept for years, into the beverage. They frequently show themselves in the Grenache wine, which does not only come from Roussillon, but also from Alicant, which is one of the principal exporting centers for dried grapes. As a general rule the wines produced from dried grapes are not considered detrimental to the health; but their commercial value is much below that of the wine from freshly pressed grapes. To substitute the former for the latter is a deception which can now be more easily proved by the presence of the mites. If wine prepared from fresh grapes should contain mites it may be taken for granted that it has been poured into an imperfectly cleaned cask, in which there had been a wine infested with mites. Hence attention should be paid to scald the casks previously with hot water. In any event it is not necessary to throw away wine containing mites. The animals remain on the surface, forming a whitish layer. Hence, it suffices to filter the wine before it is placed on the market. Finally, light also kills the mite, and by exposing the bottle to it for some hours, one is sure of exterminating the animals, if any are still present.

Science Notes.

Prof. Lenard, of Heidelberg, who first discovered the cathode rays, has received from the French Academy of Sciences its prize of 10,000 francs.

There was a time when the government of India had to import annually $250,000 worth of quinine, and did not get enough of it even then. After a great many experiments, the cultivation of the cinchona tree was made successful in India, and now there are 4,000,000 trees in Bengal, and every rural post office in India sells a five grain packet of the drug for half a cent, while the government makes from $2,000 to $3,500 a year out of the profits.

M. Flammarion, the astronomer, has been discussing the hypothesis of Schiaparelli, recently supported by Mr. Lowell and other observers, to the effect that the planet Venus, by rotating round her axis in the same period as she revolves round the sun, always presents the same face to the sun, as the moon does to the earth for the like reason. Flammarion thinks that the marks on the surface watched by Schiaparelli are effects of atmosphere and sunlight, and not on the body of the planet. He points out that the deep atmosphere of Venus probably absorbs so much of the light from its surface that we are unable to see the latter. Even the earth's atmosphere absorbs one-third of the light from the surface.

Probably the most reliable data as to melting points is published by Prof. S. W. Holman, in conjunction with R. R. Lawrence and L. Barr, in the "Proceedings of the American Academy," November 13, 1895.

Aluminum,	melting point,		660	degrees	Centigrade.
Silver,	"	"	970	"	"
Gold,	"	"	1,062	"	"
Copper,	"	"	1,095	"	"
Platinum,	"	"	1,760	"	"

The aluminum experimented upon contained 99·93 per cent aluminum, with 0·07 per cent silicon. The silver, gold, copper and platinum were of the purest quality obtainable, probably with less than three one-hundredths of one per cent of impurity in each case.

A life of the late Sir James Simpson has just been published, written by his daughter, and contains many interesting facts connected with his life not generally known before. James Simpson was the son of the village baker at Bathgate, in Linlithgowshire. At the age of fourteen he went to the University of Edinburgh, and was one of the hard-working, frugal race of Scotch scholars. He lived on $50 a year, his only extravagances being books. A significant entry is quoted from his diary, says The Medical Record. It is as follows: "Finnan haddies, 2d. (4 cents); bones of the leg, £1 10s." ($7.50) In 1838, when he was twenty-seven years old, he became lecturer in obstetric medicine in the Extra-Mural School. Two years after he was appointed professor of obstetrics at the university. In 1847 he discovered chloroform. At the early age of fifty-eight he died, his end hastened by overwork.

Prof. F. E. Nipher has recently measured the frictional effect of moving trains upon the air near them. His apparatus consisted of a hemispherical cup, which he could fix at distances up to thirty inches from the window of a railway carriage. The mouth of this collector was turned toward the direction in which the train was moving at the time of observation; and the pressure due to the motion was conveyed to a pressure gage by means of an India rubber tube attached to the back of the collecting cup. The results obtained showed that a large amount of air is dragged along with a rapidly moving train, the motion being also communicated to air many feet away. Most people believe that it is dangerous to stand near a train going at full speed, and Prof. Nipher has now proved that the moving air is a real source of danger. The air not only possesses sufficient power to cause one to topple over, but it also communicates a spinning motion tending to roll a person under the train, if the nature of the ground does not prevent such a result.

Attention has lately been called to the investigation of Dr. G. S. Hall, President of Clark University, on the things that most arouse fear. Taking the subjects broadly, it appeared that out of 298 classes of objects dreaded by 1,707 individuals, thunder and lightning were the ones creating the greatest alarm and anxiety. And yet, as pointed out by one of the electrical journals, a thunder storm might compare with Mr. John Bright's express train as the safest thing on earth to be in. Records have been carefully kept of accidents and deaths from lightning stroke or thunderbolt, and they are apparently on the decline, the period 1890–93 showing only 193 deaths a year for the whole United States. On the other hand, 200 people are drowned in New York City every year, 150 are burned or scalded to death, and 500 die from falls of various kinds. It is the rarest thing in the world, literally, for any one of Greater New York's citizens to be killed by lightning, and yet when a thunder storm invades this region most of the three million inhabitants are decidedly fearful and uncomfortable. The statistics show that, in respect of immunity from accident by lightning, the modern city is infinitely safer than the open country.

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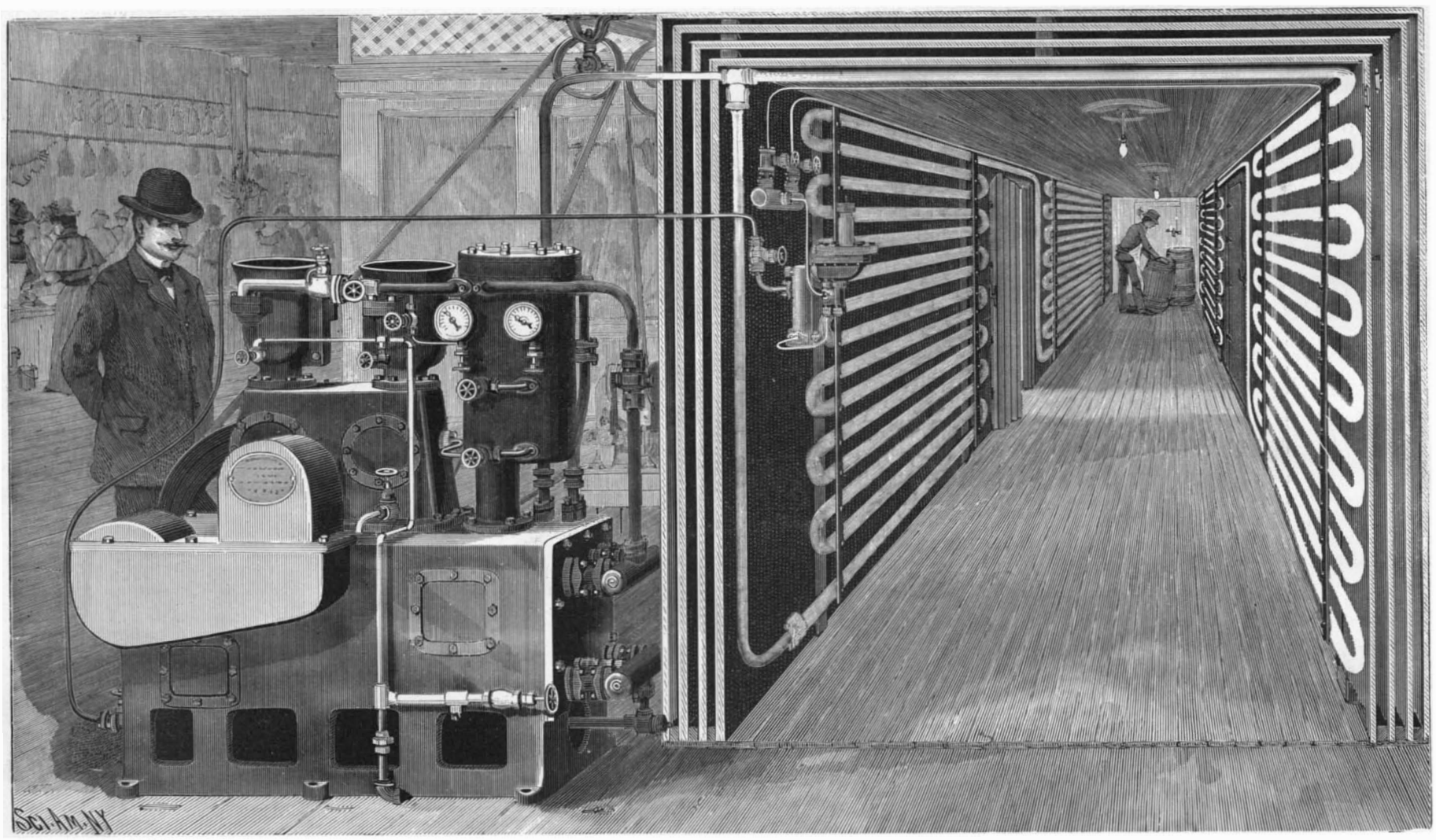
MEDIUM AND SMALL INDEPENDENT REFRIGERATING PLANTS.

It is only within the last four or five years that the makers of refrigerating machinery have turned their attention to the production of refrigerating plants suitable to the needs of small users. Previous to this period, the whole attention of manufacturers was given to the construction of large machines, which are required for refrigeration on an extended scale, and while the design and equipment of large cold storage plants has been brought to a high state of perfection, and its theory and practice are well understood, the moderate user, in the person of the small manufacturer, the storekeeper, the householder or "mine host of the inn," has been left to the tender mercies of the door-to-door ice vender.

The first attempts to produce small refrigerating machines suitable to the requirements of a single store or dwelling were made by the makers of large machinery, and were not satisfactory. Although the laws of artificial refrigeration are unvarying, the rules governing its application will vary greatly. It is one thing to refrigerate a single unit in the shape of a great room in a brewery, and quite another thing to refrigerate a number of single units represented by a score of separate refrigerating boxes, in the various flats of an apartment house; hence the earlier attempts to introduce small plants were almost invariably marked by failure. Of late years, however, the work has been taken up as a specialty by various firms, with the result that it is now possible for artificial refrigeration to be secured in small units for about the same figure as the ice is supplied by the ice companies.

The accompanying engravings illustrate the methods of refrigerating adopted by the Atlantic Refrigerating Company, of Springfield, Mass., who are devoted exclusively to the manufacture of medium and small sized plants of the kind above referred to. The refrigeration is accomplished by the compression, condensation and expansion of a highly volatile gas in a continuous cycle of operations, the compression and condensation taking place in a small and compact machine, which may be located in any convenient spot, and the expansion, with its attendant refrigeration, taking place in a coil of pipes located in the refrigerating room or "box."

The machine is of the ammonia compression type, the gas used being pure anhydrous ammonia, which is composed of 14 parts of nitrogen and 3 parts of hydrogen by weight. At ordinary temperature it is a gas, and at a temperature of about 30 degrees below



A REFRIGERATING PLANT, SHOWING REFRIGERATING MACHINE AND REGULATOR AND COILS IN REFRIGERATOR.

MEAT MARKET SUPPLIED WITH A COMPLETE ATLANTIC REFRIGERATING PLANT.

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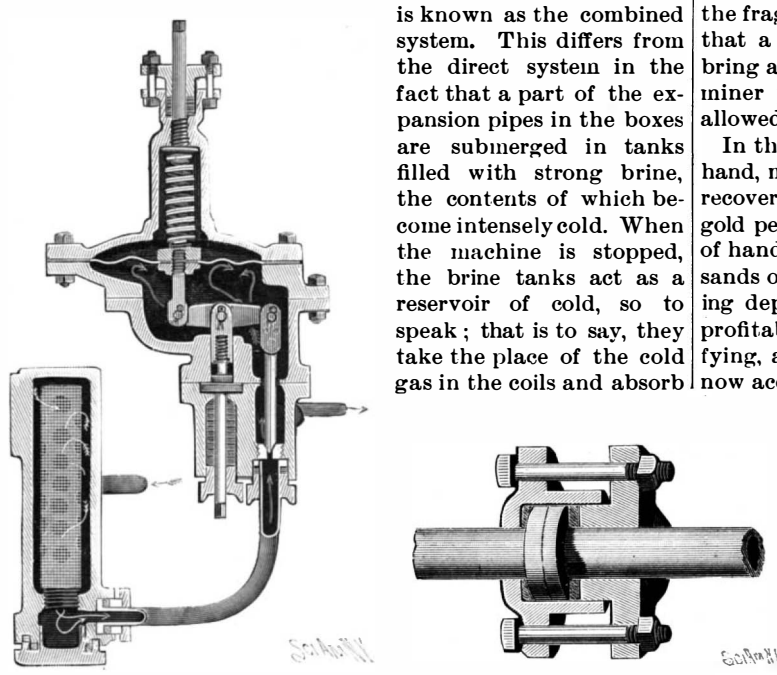
zero F. it liquefies at the normal pressure of the atmosphere, and, of course, at higher temperatures it liquefies at higher pressures.

The refrigerating apparatus shown in the accompanying cut is an extremely compact and self-contained machine, all of whose working parts are inclosed, and run in a bath of oil. It is provided with a heavy fly-wheel pulley, which may be belted direct to an electric motor or any suitable power shaft. At one end of the pulley shaft is a wrist plate which by means of a connecting rod and a rocker arm operates a rocker beam. Attached to the ends of the rocker beam are the piston rods of the two compressing cylinders, which are placed in the vertical position to avoid the uneven wear which would occur if the cylinders were placed horizontally.

The compressors are single acting and work with the smallest practicable clearance between the cylinder head and the piston. Particular attention has been paid to the design of the suction and discharge valves, which are provided with offsets on the stem which permit the passage of the gas but prevent the valve falling into the cylinder should any breakage occur. The discharge pipe from the compressor cylinders is led into a high and low pressure oil trap, located behind the cylinders, which is divided by a diaphragm into two separate receptacles. The compressed gas, at 150 pounds pressure, more or less, depending on the temperature of the condensing water, enters the high pressure half of the trap, where any oil which may have been carried over is deposited, and collects in a receptacle at the bottom. From the trap the gas is led down to a condensing coil located in the "condenser base" of the machine. This is simply a tank in which the coil is cooled by a constant circulation of cold water. Here the gas is condensed and passes down to another tank beneath it, known as the liquid receiver. The liquid ammonia is now ready for use in the refrigerating box.

The boxes may be one or more, close together or widely separated, and of any size (within the capacity of the machine) or shape desired. One of our illustrations shows the interior of a refrigerator such as might be used in a meat market, large grocery, or in any establishment where it is desirable to refrigerate a considerable amount of material in bulk. The liquid ammonia is led by a small pipe from the machine to the refrigerator, where it passes through a very ingenious automatic expansion valve which controls the flow and adjusts itself to any pressure at which it may be set. The regulation is effected by means of a flexible diaphragm controlled by the pressure of the gas, which acts on a needle valve at the mouth of the liquid ammonia supply pipe. The moment the liquid enters the regulator, which is set for a pressure of fifteen pounds to the square inch, more or less, according to the amount of refrigeration required, it volatilizes, and in so doing produces extreme cold which absorbs the heat from the surrounding atmosphere. At this lowered temperature the gas then passes into coils of pipe which are arranged on the walls or ceilings of the refrigerator. When the expansion valve has been set at the proper tension, it will admit just sufficient ammonia to insure the refrigerator being maintained at whatever temperature is required. Moreover, when the compressor is shut down it will automatically shut off the supply of gas to the coils. After the gas has traversed the coils it is led back to the refrigerating machine and passed through a coil in the condenser and then led into the low pressure receptacle of the "trap." From the trap it is again drawn into the compressors and sent on its course through the pipes.

The method above described is known as the direct expansion system. The Atlantic Refrigerating Company also make use of what is known as the combined system. This differs from the direct system in the fact that a part of the expansion pipes in the boxes are submerged in tanks filled with strong brine, the contents of which become intensely cold. When the machine is stopped, the brine tanks act as a reservoir of cold, so to speak; that is to say, they take the place of the cold gas in the coils and absorb the heat from the refrigerator box, maintaining the low temperature until the machine is again started. The company also makes use of the brine system, which differs from those already described in the fact that the ammonia pipes are not placed in the rooms or boxes to be cooled, but in a brine tank (located usually in the basement of the building), and the cooled brine is circulated through another set of pipes placed in the rooms or boxes.



SECTION THROUGH REGULATOR, AND COUPLING.

The uses to which these compact and self-running machines can be put are many and various. The accompanying illustration shows a six ton plant, installed in a city meat market. At the far end is seen the large refrigerator box divided into a large beef room, a room for general storage and a freezing room, the temperature of which may be reduced to zero. At one side of the room is another box containing four large corned-beef tanks and tubs of high-class salted meats, and a further and entirely novel application is shown in the construction of the horseshoe shaped counter. This is nothing more or less than a continuous refrigerator box with a plate glass top, in which are shelves upon which plates of cut meats, chops, steaks, etc., may be placed and inspected by the buyers. Another form of installation which is likely to meet with extended application is the refrigeration of apartment buildings.

Plans are being prepared for the equipment of a large six story apartment building with some thirty domestic refrigerators—one to each suite of rooms—all of which will be operated by a single machine in the basement. The refrigeration will be included, like the light and steam heat, in the rent. Such an arrangement would insure the abolition of the ice box with all its attendant inconveniences, a relief which would be greatly appreciated by the average householder.

DREDGING FOR GOLD.

Gold mining operations in the country lying west of the Rocky Mountains are just now being carried on by two very different systems. In the frozen North the pioneer is searching for the rich placer deposits where the fragments of gold are so large and so thickly strewn that a single season's work with the miner's pan may bring a fortune. In his feverish haste to grow rich the miner pays no attention to the finer gold, which is allowed to run to waste in the tailings.

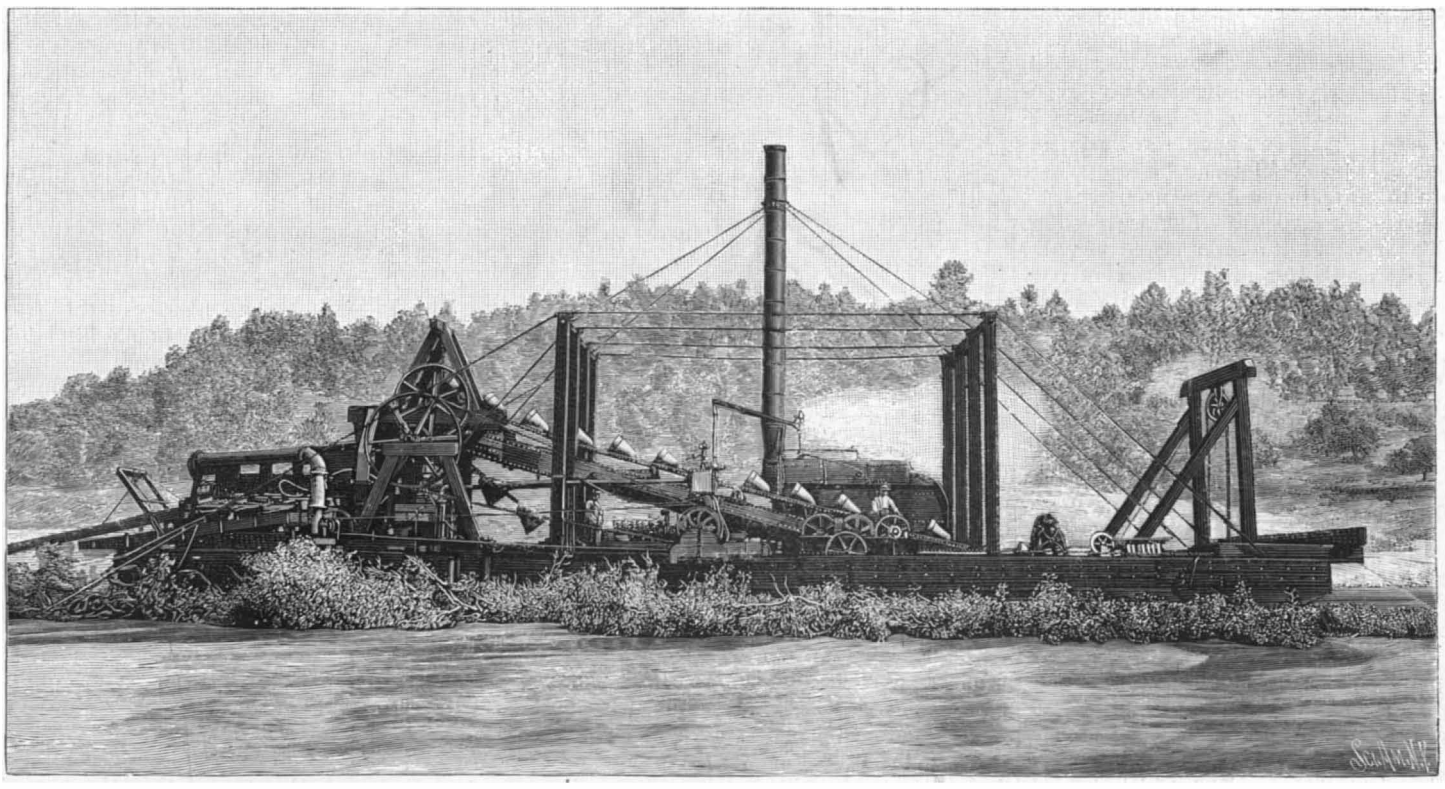
In the historic gold fields of California, on the other hand, mining men are giving increased attention to the recovery of gold from placer deposits, where the yield of gold per ton is very low. Improved machinery, capable of handling the auriferous material at the rate of thousands of tons per day, is being employed on gold bearing deposits which hitherto it has been considered unprofitable to work. The results have been very gratifying, and many discarded or neglected districts will now acquire a positive value.

The accompanying cut represents the Risdon Improved River Gold Dredge, as designed by R. H. Postlethwaite, consulting engineer, of San Francisco, California, patents for which are held by the Risdon Iron and Locomotive Works, of that city.

These dredges are the result of a process of evolution and many years of experiments by the designer and others in New Zealand, now recognized as the leading gold dredging country of the world, from which country Mr. Postlethwaite arrived in April last for the purpose of introducing and operating his dredger in this country.

One of these dredgers is now operating on the Yuba River, in California, and is lifting and washing over 93 cubic yards of gravel per hour from a depth of 45 feet, and extracting and saving the gold therefrom, some of which is so fine that it cannot be seen by the naked eye, at a cost of 3 cents per yard. The dredger consists of two long pontoons, each 96 feet long by 9 feet beam. These are connected at the stern by a small pontoon 17 feet long and 5 feet wide, the bow being connected by a heavy overhung beam. This practically makes one boat 96 feet long and 23 feet in width, with a well hole 5 feet wide running through the center for some 75 feet.

The dredger is fitted with a power winch with six drums, all being under the control of one man. Four of these drums carry lines running from the four corners of the dredger, the other end of the lines being affixed to "dead men" or backers on the beach. The fifth drum carries the head line. With these five lines the dredger can be made to rapidly take up any position necessary, one man handling her with the greatest ease and nicety and with no loss of time. The sixth winch barrel carries the ladder line, raising or lowering the ladder as required. A ladder 67 feet long, built up as a heavy lattice girder, is hung at the stern end by a bar fixed across a heavy wooden framing. The lower end of the ladder carries a five-sided tumbler and is suspended by blocks and tackle to a cross beam. By means of a wire rope and blocks the winch can raise or lower the bottom end as required. The top tumbler is carried by the timber framing some 3 feet above the top end



RIVER GOLD DREDGE ON THE YUBA RIVER—CAPACITY, 2,000 CUBIC YARDS PER DAY.

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of the ladder. The continuous bucket chain comes up the top side of the ladder on rollers round the top tumbler and back in a catenary curve to the lower tumbler. The top tumbler is driven through a rope transmission and heavy gears by the engine, a vertical compound condensing one, which also drives the pump and indicates 35 horse power.

The buckets discharge the material onto a delivery plate, down which it shoots into a revolving screen or grizzly. The centrifugal pump, throwing 3,000 gallons per minute, supplies water to a perforated pipe inside the screen. This water thoroughly washes the material, the finer wash dirt and gold going through holes in the screen and falling into a distributing box. From the distributing box it passes onto a set of gold-saving tables, 11 feet wide, over which the wash dirt runs in a thin or shallow stream, and thence into a flume. The tables are covered with cocoa matting and expanded metal, a finer gold saver than which was never used. The stones and rocks pass through the screen down a stone shoot, either direct into the river, or, when working into a high face of gravel, onto a tailings elevator.

Broadly speaking, with such a dredger as is above described, any ground which is not deeper than 60 feet below water level nor more than 20 feet above, and which contains bowlders of not more than say one ton weight, can be handled at from 3 to 5 cents per cubic yard. The ground need not be in a river, provided the seepage is sufficient to float the dredger and keep the water clean enough to wash the dirt with. The introduction of this dredger will revolutionize placer mining in this country and will render valuable large tracts of land heretofore, on account of their low grade condition, unworkable and consequently worthless.

How it Feels to be Asphyxiated.

Philip Rearden, superintendent Abbott Quicksilver Mining Company, of Illinois, Sulphur Creek, California, relates his experience with mining gas in The Mining and Scientific Press, San Francisco, as follows:

In our mine we sometimes have to contend with sulphureted hydrogen, chlorine gas, carbonic acid gas and marsh gas, sometimes called fire damp; and lately have had all these to contend with at the same time and place. We had struck the ledge, finding, in addition to these gases, some petroleum, with a heavy flow of water equal to about 4 miner's inches when we were driven out of the tunnel by the excess of sulphuric acid gas, called by our miners sore eye gas, owing to the fact that it affects the eyes so that the men are temporarily blind, and suffer great pain while the eyes are affected. We had discontinued work temporarily, while preparing to put in artificial ventilation. I and my brother went in to examine the tunnel. He had stopped to look at something about 250 feet from the breast. I went ahead to the breast carefully trying for carbonic acid gas along the floor with a candle, also along the roof of the tunnel for marsh (or inflammable) gas. I found neither with the light, but within a few seconds after reaching the breast, where a large flow of water was coming out of the ledge, I found that I was getting very short of breath. I tried to recover, but could not do so. My candle was burning brightly. I turned and ran back toward the mouth of the tunnel, perhaps 100 feet, at the same time calling to my brother to come to me. I began to get weak, lose consciousness, and fell to the floor. I could not rise again, although trying hard to do so. I felt just like one in a nightmare, trying to move, but unable to do so; but felt no pain whatever, not even strangling or coughing sensation. At this point my brother reached me, and pulled me back toward better air, where I revived within a minute or two. In this case asphyxia was probably caused by chlorine gas.

I have several times helped to take men who had been suffocated out of mines, and their faces and positions showed no signs of pain or any suffering. I had wondered at this, but now I know how a person might be asphyxiated while his light burned brightly, and would suffer no pain whatever to warn him of approaching danger.

Feeding Plants.

The following note by Mr. Paul, of Cheshunt, in The Gardeners' Chronicle, October 23, 1897, on the method employed by M. Georges Truiffent of administering artificial food to plants, is of considerable interest to horticulturists. After an analysis of the ash of the living plant, the necessary salts for a given time, such as six months, are weighed out and inclosed in a metal cover to form what is called a "pill," which is presumably inserted in the pot, diffusion of the salts taking place through the folds of the metal, and the thicker the metal, the slower the diffusion. As the salts dissolve and disappear they are replaced by a core which expands until it completely fills the "pill." The salts have no action on the metal cover, which remains firm and hard. It is stated that the solubility of the salts can be so regulated that a "pill" may be made to last three or six months, as may be desired. By this method of feeding large well colored plants are grown in pots of less than half the usual size.

A LATEEN ICE BOAT.

During the past few years much study has been given to the best form of a sail for an ice boat for the purpose of obtaining the greatest propelling result under a given force of wind pressure.

One fault of the ordinary square sloop sail was that the force exerted above the center of the sail was so great at times as to cause the windward runner to rise from the ice and tilt the sail to such an angle that the wind would spill over the top of the sail and prevent the attainment of high speed.

Lately it has been the study of ice boat experts to overcome this defect and provide a sail and rigging which would remain in a vertical position and prevent the leakage or loss of wind power. This has been successfully accomplished by the adoption of the lateen triangular sail especially rigged and designed by H. Percy Ashley, of this city.

It will be seen from the illustration that the center of pressure is quite low near the boat, and by making the sail taut or by bagging it the proper wind angle can be easily ascertained. The area of the top of the sail is so small as compared with the lower portion that there is never top pressure enough to raise the windward runner off the ice.

The mast, it will be observed, is composed of two parts forming an inverted ∧, or it may be called a wishbone mast. The sail is held by a bridle which is raised and lowered by a halyard in the usual way. The runners are of the rocker type, curved at each end.

AN IMPROVED ICE BOAT.

Practical trials of lateen boats on the Shrewsbury River, Hudson River and in Canada have proved them to be more comfortable and speedy than the ordinary style. A model of one was exhibited at the Sportsmen's exhibition in this city lately and attracted considerable attention.

Working plans of this ice boat will be found in the current issue of the SUPPLEMENT, No. 1154.

The Largest Steamship Companies of the World.

According to the latest edition of the "Repertoire General" of the Bureau Veritas, there existed upon the registers of the various maritime nations at the time of the publication of the work 29,315 sailing vessels measuring 8,894,732 register tons (against 29,348 ships and 9,136,560 tons in the previous edition of the book), as well as 11,271 steamers measuring 17,889,006 register tons (against 11,155 steamers and 17,089,596 tons). These figures show that steam tonnage is still increasing at the expense of sailing tonnage, but that the latter is decreasing in a smaller proportion than was noticeable a few years ago.

The publication of this new volume renders it possible, says The Marine Record, with the added assistance of Lloyd's Register and other authorities, to complete a list of the most important steamship companies of the world, and to show precisely how they compare with each other. According to the statistics thus available, it appears certain that the claim which has been frequently put forth on behalf of the Hamburg-American Packet Company of being the largest shipping company in existence is a just claim, beating as it does the largest British company (according to tonnage, the Peninsular and Oriental Steam Navigation Company) by 3,805 tons gross and 10,154 tons net. The following is the list:

Companies.	No. of vessels.	Gross tonnage.	Net tonnage.
British.			
P. & O. Steam Navigation Co. (London)	60	282,140	164,836
British India Steam Navigation Co. (London)	97	251,429	162,482
T. Wilson, Sons & Co. (Hull)	82	159,793	103,450
Pacific Steam Navigation Co. (Liverpool)	41	128,336	77.774
Cunard Steamship Co., Limited (Liverpool)	27	119,471	65,011
Ismay, Imrie & Co. (White Star Line) Liverpool	21	114,290	68,264
Union Steamship Co. of New Zealand (London)	52	65,239	39,371
Irrawaddy Flotilla Co., Limited (Glasgow)	42	20,393	12,367
German.			
Hamburg-American Packet Co. (Hamburg)	69	286,945	174,990
North German Lloyd (Bremen)	67	265,613	152,196
Hamburg S. American S. Nav. Co. (Hamburg)	32	100,646	65,422
Hansa Steamship Co. (Bremen)	37	84,867	54,446
French.			
Messageries Maritimes Co. (Marseilles)	63	229,837	114,000
Comp. Generale Transatlantique (Paris)	64	166,701	72,713
Italian.			
Navigazione Generale Italiana (Rome)	96	171,041	105,598
Austrian.			
Austrian Lloyd (Trieste)	72	146,560	87,800
Spanish.			
Compania Transatlantica (Barcelona)	36	121,161	78,702
Danish.			
United Steamship Co. (Copenhagen)	109	85,525	50,719
Russian.			
Russian Steam Nav. and Trading Co. (Odessa)	75	80,659	53,342
Turkish.			
Idarei Massousich (Constantinople)	69	57,842	35,664
Japanese.			
Nippon Yusen Kabushiki Kwaisha (Tokio)	68	161,698	101,383

The following are seven of the largest steamers afloat:

Name.	Length, feet.	Breadth, feet.	Depth, feet.	Gross tonnage.	Net tonnage.	Displacement, tons.
Kaiser William der Grosse (Ger.)	625	66	43	14,349	5,521	20,500
Lucania (Brit.)	601	65·2	37·8	12,952	4,975	18,000
Campania (Brit.)	601	65·2	37·8	12,950	4,974	18,000
Kaiser Friedrich (Ger.)	600	64	41	12,000	..	17,000
Pennsylvania (Ger.)	560	62	42	12,261	7,861	23,500
Pretoria (Ger.)	560	62	42	.....	.....	23,500
Augusta-Victoria (Ger.)	592	56	33·8	8,479	3,568	15,260

Washington's Tree.

The great court of the pension office at Washington has, since the advent of the present administration, been turned into a scene of tropical beauty and freshness second only to the government greenhouses of the capital city. Through the efforts of Commissioner Evans, Chief Clerk Bayly, and especially Superintendent Barnes, donations of trees and plants have been secured from the National Botanic Garden and other sources.

A valuable addition to the collection was recently made by Col. Bingham, who has charge of the White House conservatories. As the palm house adjoining the Executive Mansion was needed to accommodate the Marine Band on state occasions, the largest trees were transferred to the pension office. Among the number are some noble specimens of Sabal, Cocos and Seaforthia, but by far the most interesting tree is a venerable sago (Cycas revoluta) which once belonged to George Washington. This priceless relic is known to be at least two hundred years old, and yet it appears to be in its prime, putting forth regularly every two years a new crown of beautiful, feathery leaves and a mass of woolly, yellowish-white flowers and fruit.

Many unsuccessful attempts have been made to obtain a complete history of this tree, which is perhaps the oldest specimen of its kind in the United States. The following facts were obtained from Mr. Pfister, head gardener of the White House, and it is probably all that will ever be known of the past life of the wonderful old sago:

About the year 1780, a Baltimore merchant, owning a line of small vessels plying between that city and Havana, brought over from Cuba this tree, which was then of advanced age. As it was probably the only specimen of its kind in this country at that time, it was a genuine curiosity, and the merchant presented his prize to the first president. The tree stood about ten years in the grounds at Mount Vernon, and then it went back to Baltimore, Washington having given it to a lady of that city. For many years it remained in her family.

Fifty years ago there was a public sale of this lady's estate. Hearing of this, the head gardener hastened to avail himself of the opportunity to gain possession of the historical tree. He attended the auction for that purpose, and, after some sharp bidding, secured the prize (at what figure is now unknown) and placed it in the conservatory at the Executive Mansion, where it has stood ever since, until removed to the pension office.

The tree stands about six feet high above the surface of the earth in its box.

For these particulars we are indebted to Mr. L. S. Perkins, of the pension office.

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HABITUAL ATTITUDES OF ANIMALS CONSIDERED AS A DEPARTMENT OF COMPARATIVE ZOOLOGY.

BY J. CARTER BEARD.

The possible existence of a field for investigation in what may, perhaps, be called, taking words in their broadest sense, the geometry of character, must be assumed, and one or two aspects, however superficial, of obvious facts within its precincts be glanced at before the author's imperfect suggestions on the subject of the present contribution can be intelligently considered.

A well known and universally recognized instance of correspondence between the inter-relation of lines and angles and the character of the organisms they measure is, of course, found in the gnathic index, popularly called the facial angle, the angle formed by two straight lines, one extended from the most prominent part of the forehead in a skull (the nasofrontal suture) to the front edge of the upper jaw, at the insertion of the teeth, and the other from this point to the middle of the opening for the ear (the basion). The skull being so placed as to bring the second line into a horizontal position, the significant angle is formed that directs the other line, like an infallible hand upon the cosmic dial, to the rank and order in creation which the animal owning such a cranium must necessarily hold.

In the ideally perfect human skull, wherein is developed the greatest symmetrical capacity for the highly organized brain that occupies it, the hand upon the dial is vertical and orthognathus to the horizontal line; in skulls of a lower order it is proportionately depressed. But I cannot help thinking that there is, perhaps, no very good reason for calling a halt here, and that as the principle holds in one instance, it may be worth trying in another. If, for example, these two lines and their included angle can be used as a test in estimating the grade of intellectual capacity represented by any given specimen of a human skull, it seems possible we may find in them the measure of a man as to his whole physical organism.

Certainly to homo sapiens an erect posture is more natural and habitual than to any other mammal, far more so than any of the apes, whom the bears surpass in this respect, and he covers in standing a smaller portion, in proportion to his size and bulk, of the surface that supports him than any other animal. As to his complete frame, as well as to his skull, he represents the vertical line. Standing with his back to a flat wall, and stretching out his arms laterally at a right angle to his body, he touches the surface behind him with his head, his heels and all projecting parts, such as the calves of his legs and his shoulders, as well as with his arms and hands. From finger tip on one hand to finger tip on the other a perfectly formed man, in such a position, covers a line exactly equal to one extending from the crown of his head to the soles of his feet. The measure of a man is four square, and the simplest expression of his framework is a Latin cross. It scarcely need be said that this measure and attitude is peculiarly his own. No other mammal is capable of sharing it, for no other mammal has the power of such lateral movement at the shoulder joints combined with a perfectly upright position. In ordinary quadrupeds, as dogs and horses for instance. the limbs extend from the body parallel to the mesial plane, and when the animal is forced to take an erect posture, project forward and cannot be spread out to take a straight line across the back. In the highest of the anthropoidea, the great apes, a nearer approach to this crucial attitude is doubtless possible, but, as was long ago pointed out by Prof. Owen,* the manner in which the skull is placed upon the bones of the neck, the shortness and comparative weakness of the loins and the position of the bones in which the thighs are articulated, almost in a line with the spine, make it practically impossible for these mammals to stand unsupported bolt upright upon the soles of their feet. A more or less semi-erect position, however, is characteristic of all the most distinctively manlike apes, and bending at the knees and the loins and the head, as they do, diagrams portraying the simplest possible expression of their distinctive attitudes would, instead of depicting a full faced aspect, as in the case of a human being, necessarily have to represent a profile view, and this is also true of all the lower mammals. Space would be wanting in a much longer and more elaborate article than the present one to follow out this phase of the subject or even to notice, however cursorily, the curious results obtained by measuring the comparative length and graduated obliquity of lines produced by and expressing the habitual attitudes of mammals, neither reclining, crouching nor sitting, but resting in as erect a posture as is natural to them, from the vertical, assumed by man alone, to the horizontally prone position of the moles and the duckbill, and again descending to the depressed oblique in sloths, to end in the antithesis of that of the bimana, the reversed situation of the several parts of the body in their relation to each other that is habitual to bats, when not in action, as they rest hanging suspended, head downward.* It is worth remarking, as indicating some possible, if very remote and not easily understood, relation between such widely separated animals, that certain groups of birds, as the crossbills and the parrots, show a tendency to assume this attitude, particularly the genus Coryllus or bat parrots, as they are called. When sleeping, or even when feeding, these birds hang head downward from the branch upon which they roost or from the wires of their cages. More extraordinary still are the colies or mouse birds (Collina capensis), which, like certain species of bats, are said invariably to sleep head downward, congregated into globular masses, each consisting of a number of birds.

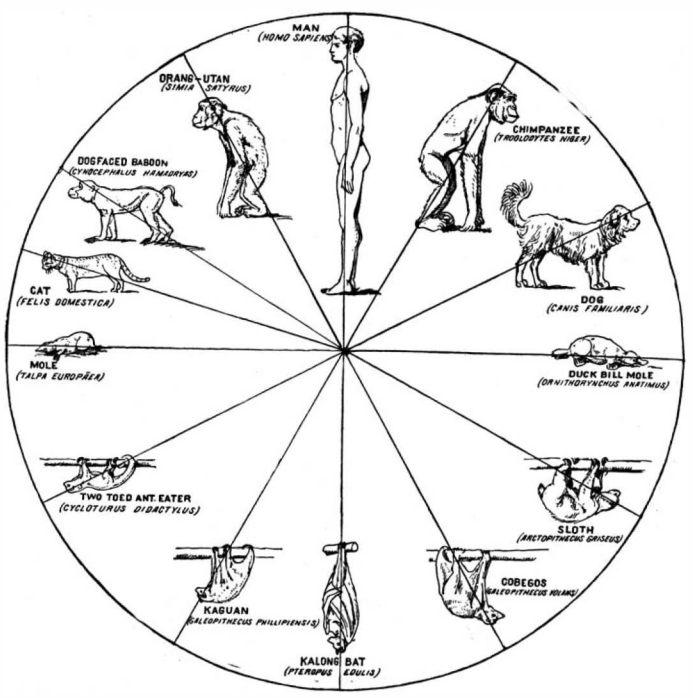
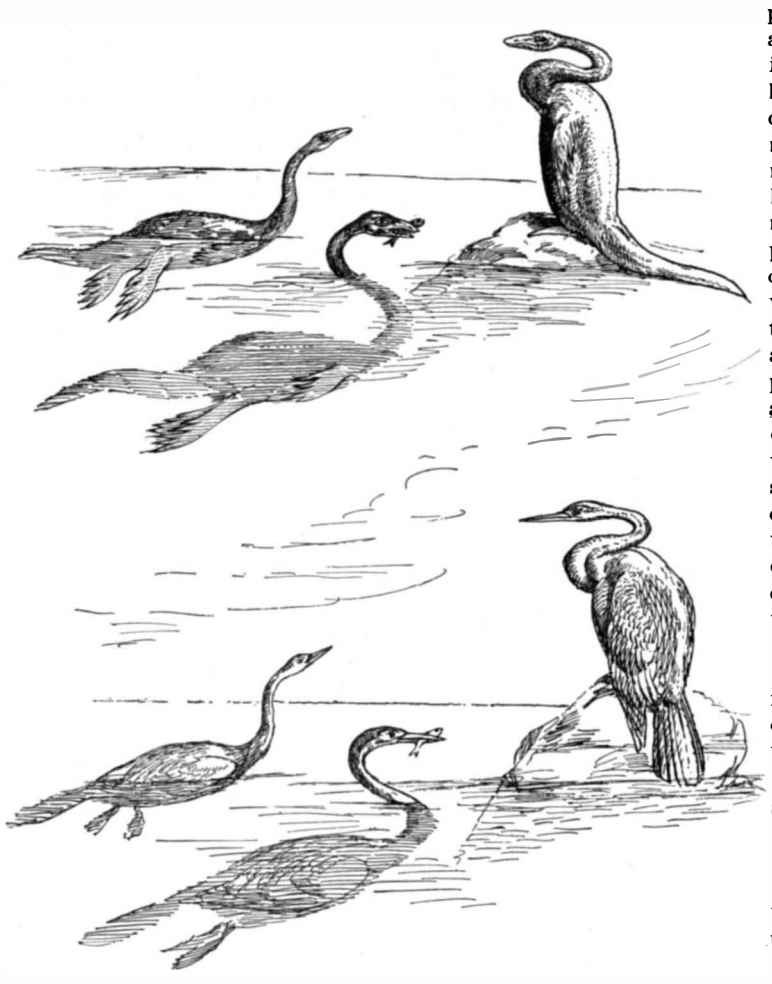


DIAGRAM SHOWING NATURAL ATTITUDE OF CERTAIN MAMMALIA. THE LINE PASSES THROUGH EAR AND HEEL.

The power of curling up into compact balls possessed by certain mammals is undoubtedly a sign either of a low grade of organization or of an inferior ancestry. It is found in the greatest perfection in the duckbill mole (Ornithorhynchus anativus) and the armadillos. It is also possessed by the porcupine echidna (Echidna hystrix) and to some extent by the aardvark (Orycteropus capensis) and the sloths. Strange to say, the lemurs, a family placed among the primates or highest order of mammals, on account of a certain resemblance, largely external, they bear to the monkey tribes, have, to a certain extent, inherited this habitual posture, which, together with affinities they show in other respects to inferior types of animals, seems obscurely to point to a lowly organized ancestry.

Indeed, habitual attitudes assumed by certain animals bear so evident a relation to extinct forms that some sort of connection between the two is strongly suggested. The so-called snake bird of Florida (P. ahinga), as it swims beneath the surface, its body concealed in the water and its long neck drawn back ready to dart upon its prey, irresistibly reminds one of the restored figure and conjectural description of the habits of certain extinct reptiles of the Cretaceous period, some one of the smaller species, perhaps, those of long necked aquatic lizards, the plesiosaurus with birdlike head, beakshaped jaws, swimming, not by means of its tail, as did the fish lizards, the Ichthyosauri, but its paddles, "arching back its long neck," says Prof. Hutchinson, "like a swan, occasionally darting it down at the fish which happened to swim within its reach," its body sometimes submerged and sometimes floating at the surface of the water. Let the reader compare this with the excellent description given by Dr. Brewer of the American snake bird: "It lives principally upon fish, which it seizes by rapidly darting upon them with its toothed and sharply pointed beak. In this movement the neck, which is very long, is thrust forward with the force of a spring by the large and well developed muscles in the lower and anterior portions of the neck. It is the best of fresh water divers, disappearing beneath the surface with the quickness of thought, leaving scarcely a ripple upon the spot, and reappearing, perhaps, with its head only above water for a moment, at a place several hundred yards distant. When swimming and unmolested it is buoyant and moves with its whole body above water; but when in danger it sinks its body, leaving only the head and neck out of the water, presenting the appearance of a portion of a large snake."

In the two sketches given, the ahinga or snake bird, in three characteristic attitudes, affords a suggestion in restoring corresponding ones of the extinct long-necked aquatic lizard, the plesiosaurus, on the basis of the general truth that similarity of construction both follows and implies similar habits, as whales and dolphins have come to resemble fish, and also that such resemblance in conformation and arrangement of parts involves and renders unavoidable a proportional similarity in characteristic attitudes, as is seen indeed in many cases, for instance, in the swift and swallow, which, though belonging to different families, are almost identical in postures and manner of flight. There is nothing to show that the long-necked plesiosaurus, though essentially aquatic, was exclusively so. The proportional large size and development of both pairs of so-called flippers as compared with those of its contemporary the ichthyosaurus, or fish lizard, or to the fins of the whales or sirena, seem to indicate other uses than those of mere paddles. Certainly, as far as its anatomical structure is concerned, the plesiosaurus seems as well fitted to go ashore as walruses and fur seals, and there can be little doubt, I think, that these animals left the water occasionally, at least during the breeding season. In fact, among the myriad inhabitants of the water we know no long-necked animal that is exclusively aquatic or any that has well developed flippers, whether these flippers have claws or not, that does not come ashore; the tail, too, stout and shaped like that of many of the old dinosaurs or the modern kangaroos, suggests its use, as in the animals mentioned, for support in sitting upright. It may now be definitely asserted that it is altogether probable the digits were well marked and separated.



PLESIOSAURUS AND SNAKE BIRD—THEIR SIMILAR ATTITUDES.

No attempt has been made to indicate respective sizes of bird and reptile, the plesiosaurus being perhaps as many feet as the bird is inches in length.

Although, of course, any attempt to connect this bird and reptile by the methods ordinarily used by comparative anatomists would be futile, the great similarity in the general plan of construction in the two animals, and the consequent identity of their characteristic postures, ought to aid greatly in forming a vivid mental picture of creatures extinct long before the light of the sun portrayed images of nature upon the human brain.

In another instance, however, the bridge between the extinct and surviving form is not so completely broken down, and not only the characteristic attitudes, but the anatomy of the bird, points too distinctly to extinct reptilian ancestors to be otherwise interpreted.

(To be continued.)

* Richard Owen on the osteology of the chimpanzee and orang-outang. Transactions of the Zoological Society, i, page 343.

* Of course such lines and measurements cannot be made to apply to aquatic mammals that are either footless, as the whales, or that do not rest or support themselves upon legs and feet, as the seals, nor to those, to use a Hibernicism, whose standing position is a sitting one, as is the case with the kangaroos and the jumping mice. These require a different system of diagrams, as do birds, reptiles, batrachia and insects.

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RECENTLY PATENTED INVENTIONS.

Engineering.

DRAWBRIDGE.—William L. Sampson, Ocean Grove, N. J. A bridge of comparatively light weight, and which is strong and durable, and may be quickly opened and closed, has been devised by this inventor. The draw spans each consist of a framework traveling on wheels on tracks laid in the bed of the waterway, the spans being moved to open or closed position by a rope or chain passing over a pulley in the bed of the waterway and around a drum on shore, the latter being operated by any convenient source of power. When the draw is open the approaches to the draw span present an upward incline designed to prevent accidents by the attempted passage of teams or passengers.

Electrical.

INCANDESCENT LAMP.—Forest W. Dunlap and John R. Quain, London, England. This invention provides an improved light refracting and magnifying envelope to concentrate the light rays downward or as required, but without causing shadows in the opposite direction. With this view the bulb is inclosed by a closely wound spiral of glass rod of circular or other section, having throughout its length the property of a biconvex lens or prism, producing a concentrating and magnifying effect. When not required to apply the envelope to the entire lamp, the upper or the lower half may be employed as desired.

Bicycles, Etc.

BICYCLE PROPELLING MECHANISM.—Erling Slippern, Anaconda, Montana. Besides the usual foot-propelling mechanism, the handle bar, according to this invention, is made with each side separate and with gear or toothed connections, whereby the up and down motion of the two sides of the handle bar may be communicated through a link to a sprocket wheel mounted on the forward part of the frame, this wheel being connected by a sprocket chain with the main crank shaft. The arrangement is such that the motion of the handle bars will be opposite that of the pedals, the right handle bar rising while the right pedal is descending.

ELASTIC TIRE.—William F. Williams, London, England. This tire is made of a band of rubber or rubber and canvas in which are embedded juxtaposed transverse spiral springs, the band having lateral extensions stiffened by non-coiled prolongations of the springs, and being transversely arched when applied to the wheel rim, on which it is retained by engagement of the lateral extensions. The device is designed to combine the advantages of a pneumatic tire with the durability of a solid rubber tire.

Mechanical.

WARPING ROLLER.—John Cocker, Philadelphia, Pa. This invention provides an improved sectional drum for beam warping machines, arranged to permit of conveniently replacing a worn out or broken drum with new parts instead of procuring an entire new drum when renovating a machine. The drum shaft carries one, two or more rimmed webs, a drum rim formed with internal bosses or flanges registering with the web rims, and set screws in the web rims for adjusting and supporting the drum rim concentric to the shaft. Drum rims of different diameters may be used, and placed in position by the set screws on the webs, for the same warping machine, according to the work under treatment.

ROLLER COTTON GIN.—Frederick L. Montgomery, New York City. This invention covers an improvement on a formerly patented invention of the same inventor, providing an improved gin arranged to properly strip the seed from the lint of upland or other cotton without danger of tearing or pulling the fibers apart and without crushing or otherwise injuring the seed. A fixed stripper plate has its inner face concave and in close proximity to the peripheral face of the ginning roller, the upper end of the plate being formed into a knife edge and a movable stripper operating over the plate, while under the plate is a drawing device with rollers, one in front of the other, and held in peripheral contact with the ginning roller.

Agricultural.

CATTLE GUARD.—James Hensey, Warren, Ark. To prevent cattle or other animals from passing over railroads or other dangerous places, this invention provides a simple and inexpensive guard or gate mounted to swing transversely of the track, across which is extended a rock shaft carrying a lever, there being a link connection between the lever and gate arms extended from the shaft, and a platform bearing on the arms. The platforms may extend any desired distance at both sides of the gate or guard, and the arrangement is such that, by an animal stepping upon one of the platforms, the gates are drawn to closed position.

BEE CATCHER.—Edward Arrington, Wilkesville, Ohio. To facilitate taking and placing bees in the hive without danger of the operator being stung, this invention provides a suitable slide frame with grooves in which may be reciprocated a sliding door, controlling the entrance of a receptacle, the whole being pivotally mounted on a bracket on an extensible pole. Flexible pieces are provided to enable the operator to slide the door to open or close the receptacle while the latter is held in elevated position or near a tree limb, the agitation of the latter causing the bees to fall into the receptacle. The receptacle may be held in any desired position with respect to its support, and raised close to the swarm of bees.

Miscellaneous.

FILTERING APPARATUS.—Charles Prevet, Paris, France. This invention provides a simple and inexpensive filter, designed to be made in small pocket form for the use of soldiers, sportsmen, etc., or in larger sizes. The filter proper is composed of two shells of unsized filtering paper, between which is interposed a lens-shaped piece of perforated metal or of porous material, preferably carbon, the arrangement being such that the water will be first passed through the paper and then through the carbon, a free space being left for the filtered water to collect in. The filtering shells and internal receptacle are joined together by flat rings and closing devices adapted to retain all parts in position.

PENHOLDER.—Wellington Blend, Yonkers, N. Y. To give increased elasticity at the holding end of the penstock and thus render an ordinary steel pen less rigid than usual, enabling one to execute fine penmanship with greater freedom and beauty of shading than can be ordinarily attained with a steel pen, this invention provides for an elastic coiled wire ferrule on the penholding end of the penholder, an elastic holder plate being also attached to the penstock and projected outward into the ferrule.

FOUNTAIN PEN.—Carl J. Renz, New York City. To provide for the control of the ink from the barrel to the pen by a slight movement of a controlling valve or stem, the valve opening and closing the barrel close to the feeder, and the feeder being formed continuous with the valve, are the main objects of this invention. The feeder is placed loosely in the barrel nozzle, allowing a more than usual free circulation of air, but allowing for a gentle vibration of the feeder, whose stem extends the length of the barrel, so that when the pen is in use a greater flow of ink is obtained in rapid writing and a lessened flow in slow writing. The construction is such that the pen may be readily and conveniently placed in position on the feeder or detached therefrom.

GAS BURNER.—George I. Woolaver, Quincy, Mass. A burner designed to utilize the expansion and contraction of metals to regulate the flow of gas has been devised by this inventor, the burner being intended to stop or nearly stop the flow of gas when the flame is put out. Standing on the casing or body portion of the burner is an expansion tube, to the upper end of which and extending through it is attached a gas-conducting tube, the latter having a bypass, while a valve held by the lower end of the gas-conducting tube is seated on the casing or body portion. The burner has the usual cock, but on the extinguishment of the gas, without turning this cock, the flow of gas is so far diminished as to prevent asphyxiation or an appreciable waste of gas.

KITE.—Claison S. Wardwell, Stamford, Conn. This is a kite of simple and inexpensive construction, arranged to be conveniently folded. It is of substantially diamond shape, with a longitudinal stick and a bow or cross stick, the bow of the cross stick being maintained by a tightly drawn cross wire connecting its ends, while the ends of the sticks are connected by bounding cords or wires which carry the cover. The two sticks are preferably held in position by blocks and a binding cord.

HITCHING POST.—Elmer J. Sellers, Kutztown, Pa. A post adapted, when not required for use, to be dropped into a chamber or recess below the level of the ground is provided by this invention. The post is hollow, and is slidable in an embedded tube, in which are guides, there being means for locking the post in both its raised and lowered positions, and the arrangement being such that, by means of springs, the partial elevation of the post is automatically accomplished by depressing or otherwise operating a trigger or catch, making it unnecessary to stoop to the ground to reach the post.

NECK YOKE COUPLING.—Lord O. Snell, Athens, Pa. A coupling which permits the easy adjustment of the yoke bar on the pole after or before attachment to the harness is provided by this invention, the coupling not being liable to become accidentally detached in case of a broken whiffletree or harness. The coupling consists of a head with shank for attachment to the pole, the head extending above the shank and having a segmental guideway in which is free to move and turn the ball-shaped head of a link pivotally connected by a clip to the yoke bar.

BROOM SAWING.—Frederick A. Buck and Joseph D. Valentine, Urbana, O. To hold a broom edgewise or parallel to a saw blade while the handle is being acted on by a band saw, jig saw or other suitable saw, to cut a curve or slit lengthwise through any portion of it, these inventors have devised a novel form of support by which the body is movable freely on the table to permit the kerf to be waved and to reduce friction.

CLOTHING BOILER.—William P. Rylander, Temple, Texas. This boiler has in its upper portion brackets on which rests a cover having a central opening, and above this cover is supported a perforated upper cover, there being in the lower portion of the boiler a false conical perforated base from which a pipe leads upward to a soap box in the lower cover, from which also a surrounding perforated pipe leads downward. The soap is thus added to the water as the boiling proceeds, and there is no danger of the water or suds boiling over the exterior of the boiler.

HOUSEHOLD FURNITURE.—Charlie E. Kuhn, Johnstown, Pa. A combination article of household furniture provided by this inventor comprises a bench adapted to be used to support tubs in washing or for other purposes, a step ladder, a child's crib and a support for an ironing board or similar article, the invention covering a novel construction and combination of parts, including end frames with pivoted locking diagonal braces, removable sides and a removable slatted bottom, etc.

LOCK.—Henry D. Smith and Josiah W. Batcheller, St. Louis, Mo. A lock especially designed for use on freight cars has been devised by these inventors, whereby the doors may be securely closed by a lock located within the car, with only its operating spindle appearing at the outside. The lock is provided with a dial or disk containing a combination, which, together with the handle or knob, may be quickly and conveniently removed from or placed in engagement with the locking spindle to bolt or unbolt the lock.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

Business and Personal.

The charge for insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

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Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7332) C. H. asks: 1. How can I coat copper with quicksilver? A. Clean the copper by dipping it into dilute sulphuric acid, and then put it into the mercury, or else pour the mercury upon it and rub it around. 2. Give me the address of some electric supply house in Chicago where I can get the material to make the battery described in SUPPLEMENT, No. 792. A. Any dealer in Chicago will supply you. See our advertising columns. 3. How many volts will one Bunsen cell 5×7 give? A. About 1·7 volts.

(7333) W. C. P. writes referring to query No. 7321: The article I have seen sold for making a transfer of a picture to a white paper resembles paraffine, colored to disguise it. I have used an ordinary paraffine candle for the purpose with entire success. The transfer cannot be made very well after the ink of the picture is dry. An old print could not be transferred. Of course, the picture is reversed in transferring. The right hand becomes the left. People with articles in their hands look left-handed in the transfer.

(7334) S. C. McKay asks: 1. Is there manufactured a mechanism by which current (either the alternating or an intermittent commuted current) from a regular telephone magneto dynamo is utilized to make and break a local battery circuit? A. We do not know any such appliance on the market, but there is no difficulty in making the current make and break another circuit in the same manner as it rings a bell by a vibrating armature of an electro magnet. 2. Please explain the seeming change or loss of polarity exhibited in the common noncentrally pivoted magneto ringer. One may find the clapper persistent in hanging over to one side, but, in a few days or weeks, equally as determined to "stick" to the other side. Lightning sometimes makes this change, but I find that it often occurs in winter when there is no lightning (visible). A. In a magneto bell a polarized magnet is generally used. The armature is apt to stick on one side or the other. The shifting may be due to some slight change of adjustment brought about by atmospheric changes. 3. I have repeatedly, by putting my ear to the transmitter of a telephone, heard talking that was going on over the line, my hook being down at the time. This happens with carbon phones using either the carbon or the metal diaphragm. Also those with the extension arm. Is this not caused by the waves of sound being imparted to the body of the phone and thence to the diaphragm by the ringer coils? A. When the receiver is hanging on its hook, the circuit of receiver and transmitter is open, and the circuit of the magneto and the bell is closed. The talking may be caused by induction from the bell coils as you suggest.

(7335) B. P. B. asks: 1. Can a common magneto generator be changed in windings, commutator, or otherwise so that it can light a small (say 1 candle power) lamp? Or is the current gotten out of one either the wrong kind to light lamps, or, if it is the right kind, too weak? I refer to common battery lamps. A. If your magneto generator gives sufficient current, it would light a lamp. No special kind of winding or commutator is required. 2. If one of the generators will light a lamp, does a special kind of lamp have to be used? If so, please tell me what kind? A. No. 3. Will you please deseribe, in this issue of your paper, how an electric needle, used to kill the roots of hairs, is made and operated, and by what kind of batteries, etc.? A. This question was answered in SCIENTIFIC AMERICAN, vol. 77, No. 20, query No. 7230. A platinum needle should be used.

(7336) G. L. asks how to apply Rumkorff's condenser to the medical coil described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 569, also the number of sheets of tinfoil and the area of each. I would also like to know the difference, if any, between an induction and spark coil. A. The condenser for your coil should consist of 20 sheets of tinfoil, each 4×5 inches. Allow the sheets to project on the ends 1 inch, and the effective surface of foil will be 4 inches square. Join one side of the condenser to the plus wire from the battery and the other to the negative wire. A spark coil is an induction coil with a condenser. Both the spark and the induction coils are explained in Sloane's "Electrical Toy Making," price $1 by mail. Or we can send you for $5 the "Electrical Library."

(7337) G. A. K. writes: I am about to construct a telephone line (metallic circuit), and wish to run electric light wires on same poles for a distance of 7 miles, bare copper. Will want to carry sufficient current for about 600 to 800 16 candle power incandescent lights. What sized wire should I use, and will it require a 3-wire line or will a 2-line wire do for alternating current? How much current will twenty 16 candle power lights consume in one hour? Will there be any appreciable loss of current transmitted through 7 miles of bare copper wire if well insulated? A. You can use single phase alternating current system, using two wires, each of No. 6 B. & S. gage, generating the current at 2,000 volts, transforming it to 500 volts for the line and again stepping down to 110 volts for the lamps. It would not be safe to use bare wire on account of the high potential. There will be a loss of about 10 per cent in transmission under the above conditions. The amperes of current represent the rate of flow, and depend upon the voltage as well as the efficiency of the lamp. Twenty 16 candle power lamps, at 110 volts, would consume about 10 amperes. If used for one hour, it would be equivalent to 10 ampere hours. If the lamps were 55 volts, the current would be twice as great.

(7338) G. E. C. asks: 1. Is there a more lasting battery than the plunge battery described in the SCIENTIFIC AMERICAN of August 31, 1889, for running the simple electric motor described in March 17, 1888, number, or a more efficient motor than that one for running a sewing machine? I think of making one, and want the best. A. You can try the Edison-Lalande, some types of which will give as high an efficiency as the bichromate; but you must consider that you cannot have power without consuming materials, and if a battery yields a good amount of current, it will consume its materials rapidly. 2. How would 8 cells of dry battery work, as it would be much cleaner and handier? A. You cannot use dry cells for running motors. Dry cells are for open circuits and intermittent use only. They run down very rapidly on a closed circuit. 3. And would the motor need to be so large for 1 machine as it is said to run 2 or 3? A. While a smaller motor might run 1 machine, it is not wise to have the motor so small that there is little excess of power to meet a heavier load than the average. 4. Would 18 or 20 wire answer for smaller one? A. Yes. 5. Is electricity of any value medically, if so, how should it be used for catarrh and neuralgia and rheumatism, or where can I get information on that subject? A. For the medical use of electricity, consult your physician. It is the only safe course. 6. Where can I get the gutta percha sheets, if I have to make the plunge battery; also, the carbon and zinc plates? A. These materials can be had of any dealer in electric supplies in your city or New York. Glass jars can be used for the battery in place of gutta percha, and will be less expensive.

(7339) S. W. E. asks: 1. Can a storage battery of 25 cells, each cell giving when charged 2·1 volts, be charged by a 2-light dynamo producing 52 volts? If so, in what manner? A. Twenty-five storage cells require 25 × 2½ volts = 62½ volts pressure in the charging currrent. You would need to divide the battery into two parts in multiple to charge it with your 52 volt dynamo. You should also arrange a wire resistance—iron wire is good enough—to take up the rest of the drop. Thus: 13 × 2½ = 33 volts nearly. 52 volts are about 1½ times 33, and you will require wire enough to have a resistance about ½ as great as that of your 13 cells. What that is we cannot tell you. The charging will be very slow, as your dynamo gives but 2 amperes of current; and the charging will be at that rate per hour. Thus: If the cells are 30 ampere hours, a current of 2 amperes will require 15 hours to charge them; and similarly for any other capacity. The better way is to use a heavier current, and so reduce the time of charging. 2. Can it be charged through one mile of No. 12 galvanized iron wire? A. Yes, if there is current enough; but we do not see why any one should waste current on a mile of iron wire. It would seem to be a better way to carry the battery to the electricity, rather than to carry the electricity to the battery. 3. Can 16 candle power lamps be manufactured to use as low at 15 volts? A. Yes. Correspond with the principal lamp manufacturers.

(7340) R. C. F. writes: Will you please give an answer in the next issue of your valued publication to the following problem which we clip from local paper and which has created a discussion: "We have a problem which we would like some of our readers to send us an intelligent answer to. No. 1: A is a farmer who sells a horse to B for $90. The following day he buys the horse back from B for $80 and sells him to C for $100. What are A's profits in the three transactions?" A. The profit of all the transactions is the difference between the price of the first sale and what A had at the close of the operation, which amounts to $20. A gained $10 by the repurchase and $10 by the second sale over the first sale, or he received $110, the first sale being $90. The apparent discrepancy between the repurchase and last sale is misleading at first glance, and the difference between the first sale and the last sale only should be credited to the second sale, which shows the actual amount gained in the three transactions to be $110 − $90 = $20 profit. In commercial affairs, profits are not counted on purchases alone.

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The selling advance is the real profit, which in this case will be $20, the difference between the purchase and the sale.

(7341) A. E. H. asks: 1. How long will a zinc last in an ordinary gravity battery of four cells, charging storage cells in parallel? The zinc being covered with copper deposit, it is difficult to tell just when it is completely worn out A. A zinc of regular weight will last for six months in a gravity cell. Take it out once in a while and scrape or wash off the muddy coating. 2. Is it not better to amalgamate the zincs in the above gravity cells? A. The zincs are not usually amalgamated in the gravity cell. They are made, however, of an amalgam, so that the mercury extends throughout the whole mass. Such zincs are called composite zincs and are in the market. 3. What is the right density of the solution around the zincs (specific gravity) in a gravity battery to obtain the maximum current; and does a small percentage of iron sulphate, which is contained in commercial copper sulphate, affect the output of the battery? A. The solution around the zinc becomes saturated in a short time, and the excess of zinc sulphate then crystallizes out at the top around the sides of the glass. This should be removed occasionally. The iron has no effect. The largest current will be had with a very weak zinc sulphate solution, say sp. gr. = 1·02, but this cannot last long, since the action of the cell will raise the density of the solution around the zinc and reduce the current. An equally important condition for large current is to keep the zinc clean. This, too, is equally difficult to maintain, even if the zinc be amalgamated.

(7342) A. F. S. writes: I am building an arc lamp with a carbon $\frac{1}{8}$ inch diameter, to be used on a 110 volt circuit. I want to feed the carbon in the usual way, i. e., by a break and magnet to reduce the same. 1. Is it proper to connect the magnet in parallel with the lamp? A. Yes; that is the usual way. 2. Of what resistance shall it be, what size wire shall I use to get the same? The coil is 2 inches long by 1 inch diameter, core $\frac{3}{8}$ inch diameter. A. Give the shunt coil 100 times the resistance of the direct circuit through the carbons. With $\frac{1}{8}$ inch carbon the resistance of the arc is 5 or 6 ohms; hence, you will require 600 ohms in the shunt circuit. Use No. 30, wind your spool full and put the rest in a separate coil within the lamp. 3. Would you recommend an extra resistance coil to be used in addition to that of the magnet? A. Yes, as above. 4. What is the resistance of an arc flame at a gap of $\frac{1}{8}$ inch; also that of $\frac{1}{4}$ inch with $\frac{1}{8}$ inch carbons? A. For $\frac{1}{8}$ inch arc, about 7 ohms; for $\frac{1}{4}$ inch arc, about 6 ohms.

(7343) D. O S. writes: On page 408 of your book, "Experimental Science," there is decribed a battery, concerning which I am in want of some information. First: What is the precise chemical change which takes place between the solution and the zinc and iron elements? Second: What is the office of the black oxide of copper, placed within the cell? Third: Will wrought iron serve as well as cast iron? and, fourth, When this battery becomes exhausted, to what is this exhaustion due? I want a battery to run a small motor, and was attracted to this one by the simplicity of its construction and the statement that it "will operate several months without replenishing." I have tried a bichromate battery, but the frequent renewals necessary compelled me to abandon it. A. The cell in question is the Lalande-Chaperon cell, which has been improved in the United States under the name Edison-Lalande cell. You will find the chemical changes fully worked out in "Primary Batteries," H. S. Carhart; price $1.50, by mail. Briefly, the action of the cell is to break up the caustic soda, zinc taking the place of the hydrogen in it. The hydrogen then takes oxygen from the copper oxide at or near the iron, the negative plate forming water, and leaving the copper in a metallic state. The object is to get rid of the hydrogen, which, if allowed to accumulate on the negative plate, would stop the current in a short time. The copper oxide is put there to furnish its oxygen for the hydrogen. Wrought iron is used in some forms of this cell. In this, as in all other cells, exhaustion is due to the chemical decomposition of the materials. Here the zinc is changed into a sodium zincate, Na_2ZnO_2 and the copper oxide $CuO + H_2$ becomes $H_2O + Cu$. When all the materials are changed, the battery stops its working. There is in it no source of energy remaining. The iron is not affected by these changes, and an iron pail will last indefinitely, so far as the electric action is concerned. It will be exposed to rust from the action of the water in which the soda is dissolved.

(7344) A. J. L. asks for a formula for a polish for polishing the nickel on bicycles, or if you have already published such a formula before, please give the number of the paper that it was in. A. Rub the bright parts with rouge and lard oil. You can purchase from any dealer in bicycle sundries preparations for cleaning the nickel parts of a bicycle in an expeditious and safe manner. The polishing cloths now on the market answer admirably to keep the nickel bright.

(7345) C. A. C. asks: How canvas can be made mildewproof without injuring the fabric. A. Dissolve 1 pound of zinc sulphate in 40 gallons of water; then add 1 pound of sodium carbonate; when dissolved add 2 ounces of tartaric acid. This holds the partially separated zinc carbonate without neutralizing the excess of the alkali used. The canvas, etc., should be soaked in this solution for 24 hours and then dried without wringing.

(7346) C. B. W. asks how the paper is prepared of which dresses of dolls are made so that the color changes with the weather. A. Cobalt chloride dissolved in alcohol applied to artificial flowers or to the dresses of dolls to which you refer turns the paper or fabric pink when the air is humid; when the air is warm and dry, the paper will be purple or blue. A solution of the same constitutes one of the sympathetic inks.

(7347) T. P. B. says: Can you tell me if the phenomenon of lightning during a snow storm is possible? A. The phenomenon to which you refer has occurred when the atmosphere has become suddenly warmed above the season's average normal temperature. Lightning never occurs in cold weather without a current of warm air in the upper atmosphere.

NEW BOOKS, ETC.

THE SOCIAL MIND AND EDUCATION. By George Edgar Vincent. New York: The Macmillan Company. Pp. 154. Price $1.25.

To give "greater unity and clearer purpose to our higher education" is the design suggested in "barest outline" in this book. It treats social philosophy as the "science of sciences," notes the development of social and of individual thought, and discusses "the integration of studies," and a "tentative curriculum," from the view point of a professor of sociology in the University of Chicago, the author endeavoring to bring conceptions from social philosophy to bear upon the problem of education.

TODD'S NEW ASTRONOMY. By David P. Todd, M.A., Ph.D., Professor of Astronomy and Director of the Observatory, Amherst College. New York, Cincinnati, and Chicago: American Book Company. Pp. 500. Illustrated. Cloth, 12mo. Price $1.30.

This small textbook which Prof. Todd has just prepared is an elementary work for students. The clearness of explanation and profuseness of illustration, together with the care which has been taken to give a thorough and accurate conspectus of the latest advance all along the lines of recent investigation, which includes such a wealth of new knowledge in every department, and notably in that of astrophysics, render this work not only an ideal textbook for beginners, but the best comprehensive review of astronomy up to date for those who have studied that science before the spectroscope and the latest immense telescopes had contributed their quota of information as to the structure and composition of the universe. The beautiful pictures of the sun, moon and planets convey lessons to the youngest reader; and the simple and practical methods of making elementary experiments of observation, such as the finding of the true north pole (pp. 22, 116), and all the points of the compass, and the measuring of the diameter of the sun (p. 259) and moon (p. 239), without costly apparatus, should make many a youth an amateur astronomer. A beautiful instance of simplifying subjects which may puzzle the student is the tub and hoop experiment to illustrate precession of the equinoxes, described and illustrated on page 128. From the very beginning the practical value of astronomy is made evident, and a conspicuous application of science to everyday use is found in chapter viii, on the Astronomy of Navigation; in which the author applies the science particularly to the voyage of the yacht "Coronet," in which he sailed for Japan, in 1896, to observe the eclipse of the sun. The book is dedicated to the Messrs. James, who provided this yacht, and one of whom accompanied Prof. Todd in it to Japan.

INTRODUCTORY COURSE IN MECHANICAL DRAWING. By C. J. Tracy and E. H. Lockwood, Instructors in Sheffield Scientific School, Yale University. With numerous illustrations and full page plates. New York: Harper & Brothers. Pp. 115. Price $1.80.

This is a book for beginners, to prepare students for a more extended course, assuming a working knowledge of the elements of geometry, but omitting machine and bridge drawing, and the more advanced applications of mechanical drawing. The book also has a chapter comprehensively treaating of perspective.

THE BAROMETRICAL DETERMINATION OF HEIGHTS. By F. J. B. Cordeiro, Surgeon United States Navy. New York: Spon & Chamberlain. Price $1.

This brief monograph affords a practical method of barometrical leveling and hypsometry for surveyors and mountain climbers, presenting formulæ therefor which are free from errors, which cannot be said of some of those heretofore in use, and a new method designed in practice to give reliable results under all conditions.

THE SUN'S PLACE IN NATURE. By Sir Norman Lockyer. London and New York: Macmillan Company. Pp. 360. Price $2.75.

The interest in this book will be greatly heightened by the fact that its author has been at the head of one of the expeditions sent out to India to observe the recent solar eclipse, and the care which was taken to equip the party of which Sir Norman was the head is but the result of his long series of studies in this special line, the volume before us being only one of his numerous contributions on the subject. Since the author's publication, in 1887, of "The Chemistry of the Sun," when approximate estimates of the temperature of the sun's photosphere were carefully considered, there has been such great improvement made in the instruments used, and such a large accumulation of independent observations, that the basis on which the problem is approached has been very much broadened, and yet without giving us sufficient data upon which to reach satisfactory conclusions. All of the more recent authoritative investigations touching this subject are here considered, in connection with numerous examinations and analyses of spectra of the sun and different stars and photographic representations of nebulæ. The meteoritic hypothesis is especially considered in its many bearings as affording the most ample data for fixing the place of the sun among its fellow stars.

STREET CLEANING, AND THE DISPOSAL OF A CITY'S WASTES. By George E. Waring, Jr. New York: Doubleday & McClure Company. Pp. 230. Price $1.25.

It is not too much to say that the late Commissioner of Street Cleaning of the City of New York has made for himself a world-wide reputation in this particular line. Coming to the task of the supervision of the cleaning of the streets of New York at a time when they were sadly in need of thorough and energetic work, and when the department had been for a long time suffering from a want of anything like efficient organization, he introduced system and order into the business, and effected such an immediate change in the looks of our thoroughfares that the subject became at once matter of general comment. During the two years of Col. Waring's administration of the office the death rate showed a large decrease—a fact which leading physicians attribute mainly to the better condition of the streets. As to the disposal of the city's wastes, which is also treated of in this volume, our readers will remember the full illustrations and description of Col. Waring's plant and process which appeared in the SCIENTIFIC AMERICAN of August last. It is interesting to note that Col. Waring estimates that in the near future the revenue derived from the city's wastes will pay half the expenses of the work.

OIL ANALYSIS. By Augustus H. Gill. Philadelphia: J. B. Lippincott Company. Pp. 139. Price $1.50.

To meet the needs of a professor teaching oil and gas analysis in the Massachusetts Institute of Technology was the primary object in preparing this monogram, in which only the more commonly occurring oils are discussed, considering their preparation, properties, analytical constants, uses and adulterants. It is an excellent book for one desiring right elementary guidance in the judging of oils, or for beginning the study with the view of becoming an expert.

ARITHMETIC OF THE STEAM ENGINE. By E. Sherman Gould. New York: D. Van Nostrand Company. Pp. 77. Price $1.

The author, a member of the American Society of Civil Engineers, presents here a collection of simple and accurate facts and rules in readily accessible shape for practical use, touching the fundamental principles of the practical operation of the steam engine.

A REPORT UPON SALMON INVESTIGATIONS IN THE COLUMBIA RIVER BASIN AND ELSEWHERE ON THE PACIFIC COAST IN 1896. By Barton Warren Evermann and Seth Eugene Meek, United States Commission of Fish and Fisheries. Washington. 1898.

THE FISHES OF THE KLAMATH RIVER BASIN. By Charles H. Gilbert, United States Commission of Fish and Fisheries. Washington. 1898.

THE FISHES FOUND IN THE VICINITY OF WOOD'S HOLL. By Hugh M. Smith, United States Commission of Fish and Fisheries. Washington. 1898.

THE JACK RABBITS OF THE UNITED STATES. By T. S. Palmer, M. D., United States Department of Agriculture, Division of Biological Survey. Washington. 1897. Pp. 88.

OUTLINES OF RURAL HYGIENE. By Harvey B. Bashore, M.D. Philadelphia: The F. A. Davis Company. Pp. 84. Price 75 cents.

The author, an Inspector of the Pennsylvania State Board of Health, here sets forth, for physicians, students and sanitarians, the conclusions reached through his own experiences relative to water supply and waste disposal, the soil, habitations, and disposal of the dead. An appendix on "The Normal Distribution of Chlorine" is contributed by Prof. Herbert E. Smith, of Yale University.

The wonderful variety and the great beauty of many of the specimens of calendar work brought before the public with the commencement of each new year is a marked feature of the development of modern processes of illustration. The National Chemigraph Company, of St. Louis, Mo., Charles B. Woodward, president, send us a beautiful sample of their work in this line, the year's calendar consisting of six large plate pictures, 18 by 22 inches each, and each well worth framing, being specimens of chemigraph photo-reproduction. The same company also send us a beautiful bass relief of the Davenant bust of Shakespeare.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

FEBRUARY 1, 1898,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

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Advertising device, E. Steinhauser .. 598,396
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Washing compound, fluid, P. Gugerty 31,189

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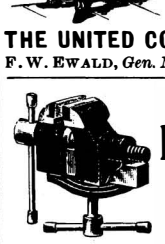

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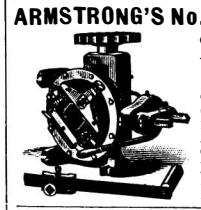

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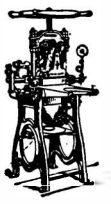

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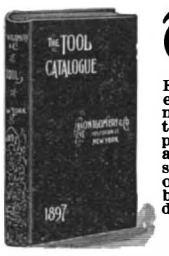

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